

## Banks,Alma

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**From:** Kiss,Michael  
**Sent:** Friday, April 13, 2007 9:29 AM  
**To:** Bauer,Jaime; Breathwaite,Troy; Thompson,Tamera  
**Cc:** Sydnor,James; Salkovitz,Daniel; Ballou,Thomas  
**Subject:** Mirant Preliminary SO2 Modeling Results



Final Complying  
Emissions Rate...

This table is in a state of flux at the moment but thought you might be interested in seeing some of the results. A few of notes for your entertainment:

1. Complying lb/MMBTU rates have a range of 0.28-1.25
2. Complying hourly emission rates range from 764-1316 lbs/hr
3. Complying daily emission rates range from 12104-20892 lbs/day
4. The projected complying annual emissions cap ranges from 6984-8493 tons/yr although it would be helpful to identify the caps for all of the 25 scenarios at some point for the purpose of completeness of the table.
5. The projected annual emissions based on compliance with the short-term emissions scenarios range from 2209-3813 tons per year. The advantage to Mirant, however, in setting the annual cap at a higher level than could be achieved through compliance with the short term limits would be if the MES was completed and resulted in an ability to relax future short term limits.

Mike

005023

Scenario	Units On	Operating Hours	Averaging Period	Complying SO <sub>2</sub> Rate (lb/MMBtu)	Concentration (µg/m <sup>3</sup> )				
					2002	2003	2004	2005	2006
12a	5	12 hrs max/ 12 hrs min	3-Hour	2.96	909	955	1,119	1,015	998
			24-Hour	1.72	252	307	300	303	278
12b	5	16 hrs max/ 8 hrs min	3-Hour	2.56	1,119	826	1,081	1,112	863
			24-Hour	1.69	237	308	295	305	271
13a	1,2	Both units 8 hrs max/ 8 hrs min/ 8 hrs off	3-Hour	1.62	891	1,027	952	821	1,118
			24-Hour	1.14	198	307	249	246	246
13b	1,2	Both units 16 hrs max/ 8 hrs off	3-Hour	1.41	737	1,112	828	884	1,052
			24-Hour	0.94	183	308	236	211	215
14a	1,3	Unit 1 @ 8 hrs max/ 8 hrs min/ 8 hrs off, Unit 3 @ 12 hrs max /12 hrs min	3-Hour	1.85	942	1,053	1,100	1,018	1,118
			24-Hour	1.08	221	307	299	286	241
14b	1,3	Unit 1 @ 8 hrs max/ 8 hrs min/ 8 hrs off, Unit 3 @ 16 hrs max/ 8 hrs min	3-Hour	1.66	1,084	944	1,119	914	1,003
			24-Hour	1.07	224	307	297	291	247
15a	1,4	Unit 1 @ 8 hrs max/ 8 hrs min/ 8 hrs off, Unit 4 @ 12 hrs max /12 hrs min	3-Hour	1.85	947	1,029	1,089	959	1,118
			24-Hour	1.12	226	307	296	292	252
15b	1,4	Unit 1 @ 8 hrs max/ 8 hrs min/ 8 hrs off, Unit 4 @ 16 hrs max/ 8 hrs min	3-Hour	1.73	1,119	962	1,020	896	1,045
			24-Hour	1.11	221	307	286	292	258
16a	1,5	Unit 1 @ 8 hrs max/ 8 hrs min/ 8 hrs off, Unit 5 @ 12 hrs max /12 hrs min	3-Hour	2.01	961	1,065	1,117	1,012	1,083
			24-Hour	1.15	226	307	275	295	261
16b	1,5	Unit 1 @ 8 hrs max/ 8 hrs min/ 8 hrs off, Unit 5 @ 16 hrs max/ 8 hrs min	3-Hour	1.83	1,117	970	1,017	927	991
			24-Hour	1.16	223	308	277	297	269
17a	2,3	Unit 2 @ 8 hrs max/ 8 hrs min/ 8 hrs off, Unit 3 @ 12 hrs max /12 hrs min	3-Hour	1.69	897	1,009	1,099	978	1,118
			24-Hour	1.03	222	306	300	286	242
17b	2,3	Unit 2 @ 8 hrs max/ 8 hrs min/ 8 hrs off, Unit 3 @ 16 hrs max/ 8 hrs min	3-Hour	1.57	1,083	937	1,116	909	1,039
			24-Hour	1.02	223	307	297	289	248
18a	2,4	Unit 2 @ 8 hrs max/ 8 hrs min/ 8 hrs off, Unit 4 @ 12 hrs max /12 hrs min	3-Hour	1.75	925	990	1,117	975	1,099
			24-Hour	1.04	222	307	291	287	252
18b	2,4	Unit 2 @ 8 hrs max/ 8 hrs min/ 8 hrs off, Unit 4 @ 16 hrs max/ 8 hrs min	3-Hour	1.67	1,119	945	1,066	931	1,048
			24-Hour	1.06	225	306	290	295	265
19a	2,5	Unit 2 @ 8 hrs max/ 8 hrs min/ 8 hrs off, Unit 5 @ 12 hrs max /12 hrs min	3-Hour	1.80	922	985	1,117	955	989
			24-Hour	1.08	233	307	271	289	262
19b	2,5	Unit 2 @ 8 hrs max/ 8 hrs min/ 8 hrs off, Unit 5 @ 16 hrs max/ 8 hrs min	3-Hour	1.73	1,117	947	1,074	933	951
			24-Hour	1.10	228	308	274	298	272
20	1,3,4	Unit 1 @ 8 hrs max/ 8 hrs min/ 8 hrs off, Units 3,4 @ 12 hrs max /12 hrs min	3-Hour	1.10	888	978	1,014	926	1,110
			24-Hour	0.68	225	303	305	289	255
21	1,3,5	Unit 1 @ 8 hrs max/ 8 hrs min/ 8 hrs off, Units 3,5 @ 12 hrs max /12 hrs min	3-Hour	1.23	967	1,058	1,115	1,022	1,110
			24-Hour	0.70	231	306	294	295	262
22	1,4,5	Unit 1 @ 8 hrs max/ 8 hrs min/ 8 hrs off, Units 4,5 @ 12 hrs max /12 hrs min	3-Hour	1.20	925	998	1,111	994	1,038
			24-Hour	0.71	240	306	286	300	271
23	2,3,4	Unit 2 @ 8 hrs max/ 8 hrs min/ 8 hrs off, Units 3,4 @ 12 hrs max /12 hrs min	3-Hour	1.08	895	968	1,112	938	1,115
			24-Hour	0.65	225	304	302	286	254
24	2,3,5	Unit 2 @ 8 hrs max/ 8 hrs min/ 8 hrs off, Units 3,5 @ 12 hrs max /12 hrs min	3-Hour	1.13	927	980	1,113	969	1,047
			24-Hour	0.66	228	305	288	288	257
25	2,4,5	Unit 2 @ 8 hrs max/ 8 hrs min/ 8 hrs off, Units 4,5 @ 12 hrs max /12 hrs min	3-Hour	1.11	906	958	1,115	955	972
			24-Hour	0.66	234	303	272	286	262
Scenario	Units On	Operating Hours	Averaging Period	Complying SO <sub>2</sub> Rate (lb/MMBtu)	1.2 lb/MMBtu Concentration (µg/m <sup>3</sup> )				
					2002	2003	2004	2005	2006
7a	3,4,5	All units @ 16 hrs max/ 8 hrs min	Annual	0.85	49.9	54.3	63.5	59.6	59.1
8a	1	8 hrs max/ 8 hrs min/ 8 hrs off	Annual	5.14	46.9	55.1	60.9	60.0	63.8
13a	1,2	Both units 8 hrs max/ 8 hrs min/ 8 hrs off	Annual	2.48	47.0	55.8	61.6	60.2	63.9



**Mirant Potomac, Alexandria, Virginia**  
**Complying SO<sub>2</sub> Rates w/ Ground Level EBDs (Existing Stacks)**

Complying Concentrations ( $\mu\text{g}/\text{m}^3$ )

3hr: 1124.6

24hr: 310

Annual: 64

Assumes Background Concentrations ( $\mu\text{g}/\text{m}^3$ )

3hr: 175.4

24hr: 55

Annual: 16

Scenario	Units On	Operating Hours	Averaging Period	Complying SO <sub>2</sub> Rate (lb/MMBtu)	Concentration ( $\mu\text{g}/\text{m}^3$ )				
					2002	2003	2004	2005	2006
1a	3 & 4	Both Units @ 16 hrs max/ 8 hrs min	3-hour	1.22	1,116	791	941	1,020	864
			24-hour	0.84	232	305	287	302	274
1b	3 & 4	Both Units @ 12 hrs max/ 12 hrs min	3-Hour	1.45	902	940	1,119	949	1,027
			24-Hour	0.89	245	305	307	307	270
2a	3 & 5	Both Units @ 16 hrs max/ 8 hrs min	3-Hour	1.22	1,113	777	906	1,026	811
			24-Hour	0.84	231	305	283	302	271
2b	3 & 5	Both units @ 12 hrs max/ 12 hrs min	3-Hour	1.50	923	955	1,114	977	997
			24-Hour	0.88	247	304	282	306	271
3a	4 & 5	Both Units @ 16 hrs max/ 8 hrs min	3-Hour	1.23	1,119	778	947	1,062	813
			24-Hour	0.84	233	306	282	302	275
3b	4 & 5	Both units @ 12 hrs max/ 12 hrs min	3-Hour	1.46	893	922	1,113	975	962
			24-Hour	0.88	249	308	296	308	284
4a	1,2,3	Units 1,2 @ 8 hrs max/ 8 hrs min/ 8 hrs off; Unit 3 @ 16 hrs max/ 8 hrs min	3-Hour	1.20	1,103	1,022	1,116	968	1,098
			24-Hour	0.74	221	306	290	284	240
4b	1,2,3	Units 1,2 @ 8 hrs max/ 8 hrs min/ 8 hrs off; Unit 3 @ 12 hrs max/ 12 hrs min	3-Hour	1.24	964	1,033	1,115	1,000	1,061
			24-Hour	0.75	220	305	293	283	238
5a	1,2,4	Units 1,2 @ 8 hrs max/ 8 hrs min/ 8 hrs off; Unit 4 @ 16 hrs max/ 8 hrs min	3-Hour	1.22	1,111	1,001	1,076	949	1,113
			24-Hour	0.77	222	308	290	290	246
5b	1,2,4	Units 1,2 @ 8 hrs max/ 8 hrs min/ 8 hrs off; Unit 4 @ 12 hrs max/ 12 hrs min	3-Hour	1.26	975	1,034	1,111	980	1,088
			24-Hour	0.77	222	308	290	288	242
6a	1,2,5	Units 1,2 @ 8 hrs max/ 8 hrs min/ 8 hrs off; Unit 5 @ 16 hrs max/ 8 hrs min	3-Hour	1.22	1,066	981	1,050	915	1,112
			24-Hour	0.79	220	306	275	292	250
6b	1,2,5	Units 1,2 @ 8 hrs max/ 8 hrs min/ 8 hrs off; Unit 5 @ 12 hrs max/ 12 hrs min	3-Hour	1.30	958	1,045	1,118	975	1,119
			24-Hour	0.79	216	307	281	282	247
7a	3,4,5	All units @ 16 hrs max/ 8 hrs min	3-Hour	0.81	1,116	776	913	1,029	808
			24-Hour	0.56	232	305	283	302	274
7b	3,4,5	All units @ 12 hrs max/ 12 hrs min	3-Hour	0.99	914	948	1,116	970	986
			24-Hour	0.58	244	302	279	302	271
7c	3,4,5	All units @ 8 hrs max/ 16 hrs min	3-Hour	1.12	1,005	1,039	1,062	1,096	1,118
			24-Hour	0.59	236	287	275	306	272
8a	1	8 hrs max/ 8 hrs min/ 8 hrs off	3-Hour	3.33	861	1,044	924	810	1,119
			24-Hour	2.29	196	308	253	235	243
8b	1	16 hrs max/ 8 hrs off	3-Hour	2.97	716	1,122	824	911	1,005
			24-Hour	1.69	171	308	234	195	211
9a	2	8 hrs max/ 8 hrs min/ 8 hrs off	3-Hour	2.94	900	980	905	800	1,120
			24-Hour	2.11	192	309	241	239	285
9b	2	16 hrs max/ 8 hrs off	3-Hour	2.71	752	1,115	835	868	1,118
			24-Hour	1.84	190	308	241	224	233
10a	3	12 hrs max/ 12 hrs min	3-Hour	2.77	891	915	1,085	902	1,121
			24-Hour	1.67	223	286	309	286	245
10b	3	16 hrs max/ 8 hrs min	3-Hour	2.49	1,118	822	975	1,017	1,008
			24-Hour	1.68	231	304	308	302	267
11a	4	12 hrs max/ 12 hrs min	3-Hour	2.92	901	935	1,122	961	973
			24-Hour	1.75	245	307	284	304	278
11b	4	16 hrs max/ 8 hrs min	3-Hour	2.40	1,119	768	922	1,030	800
			24-Hour	1.69	234	307	284	303	282

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Units 1, 2, 3, 4, 5 at Max Load

Unit #	Stack Height (m)	Heat Input (MMBtu/hr)	Capacity Factor	Temp (K)	Velocity (m/s)	Diameter (m)
Unit 1	48.158	1053	88	444.3	35.7	2.6
Unit 2	48.158	1029	88	455.4	30.2	2.6
Unit 3	48.158	1018	107	405.4	30.8	2.4
Unit 4	48.158	1087	107	405.4	33.2	2.4
Unit 5	48.158	1107	107	405.4	33.8	2.4

Units 1, 2, 3, 4, 5 at Min Load

Unit #	Stack Height (m)	Heat Rate (MMBtu/MWh)	Capacity Factor	Temp (K)	Velocity (m/s)	Diameter (m)
Unit 1	48.158	14	35	442.6	19.0	2.6
Unit 2	48.158	13.4	35	431.5	18.7	2.6
Unit 3	48.158	10.8	35	413.2	15.3	2.4
Unit 4	48.158	11.3	35	411.3	15.1	2.4
Unit 5	48.158	11.3	35	406.0	13.9	2.4

Mirant Potomac, Alexandria, Virginia  
Complying SO<sub>2</sub> Rates (Existing Stacks)

Complying Concentrations (µg/m<sup>3</sup>)

3hr: 1124.6

24hr: 310

Annual: 64

Assumes Background Concentrations (µg/m<sup>3</sup>)

3hr: 175.4

24hr: 55

Annual: 16

Scenario	Units On	Operating Hours	Averaging Period	Marina Towers EBDs Complying SO <sub>2</sub> Rate (lb/MMBtu)	Ground Level EBDs Complying SO <sub>2</sub> Rate (lb/MMBtu)
1a	3 & 4	Both Units @ 16 hrs max/ 8 hrs min	3-hour	0.38	1.22
			24-hour	0.46	0.84
1b	3 & 4	Both Units @ 12 hrs max/ 12 hrs min	3-Hour	0.38	1.45
			24-Hour	0.50	0.89
2a	3 & 5	Both Units @ 16 hrs max/ 8 hrs min	3-Hour	0.43	1.22
			24-Hour	0.63	0.84
2b	3 & 5	Both units @ 12 hrs max/ 12 hrs min	3-Hour	0.43	1.50
			24-Hour	0.54	0.88
3a	4 & 5	Both Units @ 16 hrs max/ 8 hrs min	3-Hour	0.42	1.23
			24-Hour	0.64	0.84
3b	4 & 5	Both units @ 12 hrs max/ 12 hrs min	3-Hour	0.42	1.46
			24-Hour	0.55	0.88
4a	1,2,3	Units 1,2 @ 8 hrs max/ 8 hrs min/ 8 hrs off; Unit 3 @ 16 hrs max/ 8 hrs min	3-Hour	0.35	1.20
			24-Hour	0.44	0.74
4b	1,2,3	Units 1,2 @ 8 hrs max/ 8 hrs min/ 8 hrs off; Unit 3 @ 12 hrs max/ 12 hrs min	3-Hour	0.35	1.24
			24-Hour	0.49	0.75
5a	1,2,4	Units 1,2 @ 8 hrs max/ 8 hrs min/ 8 hrs off; Unit 4 @ 16 hrs max/ 8 hrs min	3-Hour	0.36	1.22
			24-Hour	0.45	0.77
5b	1,2,4	Units 1,2 @ 8 hrs max/ 8 hrs min/ 8 hrs off; Unit 4 @ 12 hrs max/ 12 hrs min	3-Hour	0.36	1.26
			24-Hour	0.49	0.77
6a	1,2,5	Units 1,2 @ 8 hrs max/ 8 hrs min/ 8 hrs off; Unit 5 @ 16 hrs max/ 8 hrs min	3-Hour	0.40	1.22
			24-Hour	0.59	0.79
6b	1,2,5	Units 1,2 @ 8 hrs max/ 8 hrs min/ 8 hrs off; Unit 5 @ 12 hrs max/ 12 hrs min	3-Hour	0.40	1.30
			24-Hour	0.49	0.79
7a	3,4,5	All units @ 16 hrs max/ 8 hrs min	3-Hour	0.28	0.81
			24-Hour	0.39	0.56
7b	3,4,5	All units @ 12 hrs max/ 12 hrs min	3-Hour	0.28	0.99
			24-Hour	0.35	0.56
7c	3,4,5	All units @ 8 hrs max/ 16 hrs min	3-Hour	0.28	1.12
			24-Hour	0.32	0.59
8a	1	8 hrs max/ 8 hrs min/ 8 hrs off	3-Hour	1.25	3.33
			24-Hour	1.71	2.29
8b	1	16 hrs max/ 8 hrs off	3-Hour	1.24	2.97
			24-Hour	1.66	1.89
9a	2	8 hrs max/ 8 hrs min/ 8 hrs off	3-Hour	1.01	2.94
			24-Hour	1.47	2.11
9b	2	16 hrs max/ 8 hrs off	3-Hour	0.96	2.71
			24-Hour	1.46	1.84
10a	3	12 hrs max/ 12 hrs min	3-Hour	0.75	2.77
			24-Hour	0.98	1.67
10b	3	16 hrs max/ 8 hrs min	3-Hour	0.75	2.49
			24-Hour	0.91	1.68
11a	4	12 hrs max/ 12 hrs min	3-Hour	0.79	2.92
			24-Hour	1.02	1.75
11b	4	16 hrs max/ 8 hrs min	3-Hour	0.79	2.40
			24-Hour	0.96	1.69
12a	5	12 hrs max/ 12 hrs min	3-Hour	0.80	2.96
			24-Hour	1.06	1.72
12b	5	16 hrs max/ 8 hrs min	3-Hour	0.80	2.56
			24-Hour	1.37	1.69
13a	1,2	Both units 8 hrs max/ 8 hrs min/ 8 hrs off	3-Hour	0.55	1.62
			24-Hour	0.79	1.14
13b	1,2	Both units 16 hrs max/ 8 hrs off	3-Hour	0.54	1.41

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Scenario	Units On	Operating Hours	Averaging Period	Marine Towers EBDs Complying SO <sub>2</sub> Rate (lb/MMBtu)	Ground Level EBDs Complying SO <sub>2</sub> Rate (lb/MMBtu)
100%	1,26	Both units to fire max 6 hrs on	24-Hour	0.77	0.94



Scenario	Units On	Operating Hours	Averaging Period	Marina Towers EBDs Complying SO <sub>2</sub> Rate (lb/MMBtu)	Ground Level EBDs Complying SO <sub>2</sub> Rate (lb/MMBtu)
14a	1,3	Unit 1 @ 8 hrs max/ 8 hrs min/ 8 hrs off, Unit 3 @ 12 hrs max /12 hrs min	3-Hour	0.49	1.85
			24-Hour	0.72	1.08
14b	1,3	Unit 1 @ 8 hrs max/ 8 hrs min/ 8 hrs off; Unit 3 @ 16 hrs max/ 8 hrs min	3-Hour	0.49	1.66
			24-Hour	0.61	1.07
15a	1,4	Unit 1 @ 8 hrs max/ 8 hrs min/ 8 hrs off, Unit 4 @ 12 hrs max /12 hrs min	3-Hour	0.51	1.85
			24-Hour	0.71	1.12
15b	1,4	Unit 1 @ 8 hrs max/ 8 hrs min/ 8 hrs off; Unit 4 @ 16 hrs max/ 8 hrs min	3-Hour	0.51	1.73
			24-Hour	0.63	1.11
16a	1,5	Unit 1 @ 8 hrs max/ 8 hrs min/ 8 hrs off, Unit 5 @ 12 hrs max /12 hrs min	3-Hour	0.60	2.01
			24-Hour	0.74	1.15
16b	1,5	Unit 1 @ 8 hrs max/ 8 hrs min/ 8 hrs off; Unit 5 @ 16 hrs max/ 8 hrs min	3-Hour	0.60	1.83
			24-Hour	0.93	1.16
17a	2,3	Unit 2 @ 8 hrs max/ 8 hrs min/ 8 hrs off, Unit 3 @ 12 hrs max /12 hrs min	3-Hour	0.45	1.69
			24-Hour	0.65	1.03
17b	2,3	Unit 2 @ 8 hrs max/ 8 hrs min/ 8 hrs off; Unit 3 @ 16 hrs max/ 8 hrs min	3-Hour	0.45	1.57
			24-Hour	0.58	1.02
18a	2,4	Unit 2 @ 8 hrs max/ 8 hrs min/ 8 hrs off, Unit 4 @ 12 hrs max /12 hrs min	3-Hour	0.48	1.75
			24-Hour	0.65	1.04
18b	2,4	Unit 2 @ 8 hrs max/ 8 hrs min/ 8 hrs off; Unit 4 @ 16 hrs max/ 8 hrs min	3-Hour	0.48	1.67
			24-Hour	0.60	1.06
19a	2,5	Unit 2 @ 8 hrs max/ 8 hrs min/ 8 hrs off, Unit 5 @ 12 hrs max /12 hrs min	3-Hour	0.56	1.80
			24-Hour	0.65	1.08
19b	2,5	Unit 2 @ 8 hrs max/ 8 hrs min/ 8 hrs off; Unit 5 @ 16 hrs max/ 8 hrs min	3-Hour	0.56	1.73
			24-Hour	0.85	1.10
20	1,3,4	Unit 1 @ 8 hrs max/ 8 hrs min/ 8 hrs off, Units 3,4 @ 12 hrs max /12 hrs min	3-Hour	0.30	1.10
			24-Hour	0.42	0.68
21	1,3,5	Unit 1 @ 8 hrs max/ 8 hrs min/ 8 hrs off, Units 3,5 @ 12 hrs max /12 hrs min	3-Hour	0.33	1.23
			24-Hour	0.44	0.70
22	1,4,5	Unit 1 @ 8 hrs max/ 8 hrs min/ 8 hrs off, Units 4,5 @ 12 hrs max /12 hrs min	3-Hour	0.34	1.20
			24-Hour	0.43	0.71
23	2,3,4	Unit 2 @ 8 hrs max/ 8 hrs min/ 8 hrs off, Units 3,4 @ 12 hrs max /12 hrs min	3-Hour	0.29	1.08
			24-Hour	0.41	0.65
24	2,3,5	Unit 2 @ 8 hrs max/ 8 hrs min/ 8 hrs off, Units 3,5 @ 12 hrs max /12 hrs min	3-Hour	0.32	1.13
			24-Hour	0.41	0.66
25	2,4,5	Unit 2 @ 8 hrs max/ 8 hrs min/ 8 hrs off, Units 4,5 @ 12 hrs max /12 hrs min	3-Hour	0.33	1.11
			24-Hour	0.39	0.66
Scenario	Units On	Operating Hours	Averaging Period	Marina Towers EBDs Complying SO <sub>2</sub> Rate (lb/MMBtu)	Ground Level EBDs Complying SO <sub>2</sub> Rate (lb/MMBtu)
7a	3,4,5	All units @ 16 hrs max/ 8 hrs min	Annual	0.63	0.85
8a	1	8 hrs max/ 8 hrs min/ 8 hrs off	Annual	3.77	5.14
13a	1,2	Both units 8 hrs max/ 8 hrs min/ 8 hrs off	Annual	1.65	2.48

## Modeled Emission Rates &amp; Operating Hours

[illegible]



Modeled Emission Rates & Operating Hours										Averaging Period	Complying SO <sub>2</sub> Rate (lb/MMBtu)	Most Limiting SO <sub>2</sub> Rate (lb/MMBtu)	Complying SO <sub>2</sub> Rate (lb/hr)	Complying SO <sub>2</sub> Rate (lb/day)	24-hr Average Hourly SO <sub>2</sub> Rate (lb/hr)	Maximum Projected Annual Emissions (tonnes/yr)
max)	413.06	16	150.29	Unit 4 (min)	8	150.29	8	150.29	8	3-hour	0.38	0.38	800	15150	631	2765
max)	413.06	12	150.29	Unit 4 (min)	12	150.29	12	150.29	12	3-hour	0.38	0.38	800	13126	547	2395
max)	476.01	16	170.07	Unit 5 (min)	8	170.07	8	170.07	8	3-hour	0.43	0.43	914	17281	720	3154
max)	476.01	12	170.07	Unit 5 (min)	12	170.07	12	170.07	12	3-hour	0.43	0.43	914	14956	623	2730
max)	464.94	16	166.11	Unit 5 (min)	8	166.11	8	166.11	8	3-hour	0.42	0.42	921	17401	725	3176
max)	464.94	12	166.11	Unit 5 (min)	12	166.11	12	166.11	12	3-hour	0.42	0.42	921	15044	627	2746
max)	360.15	8	164.15	Unit 2 (min)	8	164.15	8	164.15	8	3-hour	0.35	0.35	1085	15274	636	2788
max)	360.15	12	164.15	Unit 2 (min)	12	164.15	12	164.15	12	3-hour	0.35	0.35	1085	15035	628	2744
max)	370.44	8	168.84	Unit 2 (min)	8	168.84	8	168.84	8	3-hour	0.36	0.36	1141	16158	673	2949
max)	370.44	12	168.84	Unit 2 (min)	12	168.84	12	168.84	12	3-hour	0.36	0.36	1141	15838	660	2890
max)	411.6	8	187.6	Unit 2 (min)	8	187.6	8	187.6	8	3-hour	0.40	0.40	1240	17456	727	3186
max)	411.6	12	187.6	Unit 2 (min)	12	187.6	12	187.6	12	3-hour	0.40	0.40	1240	17182	716	3136
max)	304.36	16	110.74	Unit 4 (min)	8	110.74	8	110.74	8	3-hour	0.28	0.28	889	17008	709	3104
max)	304.36	12	110.74	Unit 4 (min)	12	110.74	12	110.74	12	3-hour	0.28	0.28	889	14720	613	2686
max)	304.36	8	110.74	Unit 4 (min)	8	110.74	8	110.74	8	3-hour	0.28	0.28	889	12432	516	2259
										3-hour	1.25	1.25	1316	15430	643	2816
										3-hour	1.24	1.24	1306	20892	870	3813
										3-hour	1.01	1.01	1039	12104	504	2209
										3-hour	0.96	0.96	986	15805	659	2884
										3-hour	0.75	0.75	764	12964	524	2293
										3-hour	0.75	0.75	764	14484	604	2643
										3-hour	0.79	0.79	889	14094	586	2686
										3-hour	0.79	0.79	889	16239	677	2984
										3-hour	0.80	0.80	888	14424	601	2632
										3-hour	0.80	0.80	888	16701	696	3048
										3-hour	0.55	0.55	1145	13380	568	2442
										3-hour	0.54	0.54	1124	17988	750	3283
										3-hour	0.49	0.49				





# SOLVAY CHEMICALS

May 18, 2007

To: David Cramer

The use of trona for acid gas mitigation by injecting it as a fine powder into hot flue gases from coal fired boiler began in 1977 as part of a DOE study with Public Service of Colorado at their Cameo station. A coarse grade of trona was milled on site. After many years of evaluation they installed a full scale unit in 1989 at their Cherokee Station. Today Xcel (PSC) use Solvay's Solvair Select 200 (a fine powder material) at the Denver Cherokee and Arapahoe Stations for SO<sub>2</sub> control. The injection is prior to their baghouse at a temperature of approximately 325°F. The systems treat 4 boilers total. They have been using our trona sorbent since 1989.

In the summer of 2001 Golden Valley Electric converted from hydrated lime to Solvair Select 200 at their Helay, AK plant. The injection point is at the same relative place and temperature prior to their baghouse as Xcels.

The amount of acid gas mitigation possible at these sites is a manner of how much trona they add for a given SO<sub>2</sub> emission. The higher their ratio of trona to SO<sub>2</sub> (the Normalized Stoichiometric Ratio – NSR) the greater the SO<sub>2</sub> reduction. Both power companies mill our Select 200 to improve its utilization. The plants are regulated for a total annual SO<sub>2</sub> emission rate in tons per year. On average the plants will mitigate 45-50% of their uncontrolled SO<sub>2</sub> emissions. All boilers use a low sulfur coal. GVEA's mine is down the road from their plant in Alaska.

Solvay has been the only supplier of mechanically refined trona for this market for almost twenty years. We understand that FMC now makes a recrystallized sodium sesquicarbonate. Sodium sesquicarbonate is the chemical name for trona ore. This material is much coarser than our Select 200.

We expanded our plant by 240 ktpy last year to 320 ktpy to meet the increasing demand for this product in the flue gas market for the emission control of acid gases by dry sorbent injection. The market spans many other industries as well as other acid gases such as SO<sub>3</sub>, HCl, NO<sub>x</sub> and HF with hot and cold side ESP and baghouses for APC of the particulate.



I have been at your plant several times including the initial trial at the end of 2005. I normally try and attend all of the initial trials using our trona but there are so many occurring now I can not make them all.

I hope this answers your questions and please call if I can help further.

Regards,  
John

A handwritten signature in black ink that reads "John Maziuk". The script is cursive and fluid, with the first letter of each name being capitalized and prominent.

John Maziuk  
Technical Development Manager  
Solvay Chemicals

IN THE UNITED STATES DISTRICT COURT  
FOR THE EASTERN DISTRICT OF VIRGINIA  
Alexandria Division

UNITED STATES OF AMERICA  
AND THE STATE OF MARYLAND

Plaintiffs,

and

DAVID K. PAYLOR, DIRECTOR,  
COMMONWEALTH OF VIRGINIA  
DEPARTMENT OF ENVIRONMENTAL  
QUALITY,

Plaintiff-Intervenor

v.

MIRANT POTOMAC RIVER, LLC AND  
MIRANT MID-ATLANTIC, LLC,

Defendants.

Civil Action No: 1:04CV1136

**DECLARATION OF THOMAS R. BALLOU**

I, Thomas R. Ballou, do declare and affirm as follows:

1. I am the Director of the Office of Air Quality Analysis at the Virginia Department of Environmental Quality (VDEQ). I have served in that capacity since 2004. My office is responsible for coordinating the Department's actions concerning the designation of areas in Virginia under the federal National Ambient Air Quality Standards (NAAQS). Other key functions of this office include regional air quality modeling, emissions inventories, and air quality planning support.

2. I joined VDEQ in 1990. Prior to becoming the Director of the Office of Air Quality Analysis, I served as supervisor of VDEQ's emissions inventory group.

3. I received a Bachelor Degree in Geo-Environmental Studies from Shippensburg State College in 1981. Before joining VDEQ, I worked in the air programs of the New Jersey Department of Environmental Protection and the Region II office of the U.S Environmental Protection Agency.

4. I am generally familiar with the terms of the proposed Amended Consent Decree in the above captioned case, and in particular with the provisions of the Decree that secure reductions of NOx emissions from the four Mirant power plants located in the Washington, D.C. ozone nonattainment area.

5. The nature of ozone formation and transport in the eastern United States is such that even though the Potomac River Plant is located in the City of Alexandria, the system-wide NOx emission reductions secured by the Decree will result in a greater reduction in ozone levels in the City than would be the case if emissions from only the Potomac River Plant were reduced.

6. Ozone is formed through many chemical reactions between NOx and VOCs in the atmosphere that are driven by sunlight and accelerated by warm temperatures. The chemical reactions between NOx and VOCs in the atmosphere that produce ozone pollution begin near the source of the NOx emissions, but peak ozone production occurs between 10 and 50 kilometers downwind of the source, depending on the weather conditions. Near the stack, the freshly emitted, highly concentrated NOx reacts with existing ozone in the atmosphere—a chemical reaction called NOx titration.



ENSR  
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May 4, 2007

Mr. David Cramer  
Mirant Mid Atlantic Corporation  
8301 Professional Place, Suite 230  
Landover, MD 20785

Subject: Air Quality Improvements Associated with the Stack Merge Project

Dear Mr. Cramer,

In order to better analyze different proposals for reducing downwash from the Mirant Potomac River, LLC ("Mirant") PRGS stacks, modeling was done based on six potential scenarios. This letter first addresses Mirant background relevant to the downwash phenomenon related to the fact that the PRGS stacks are below Good Engineering Stack Height as defined by applicable regulations. Then it outlines different proposed solutions for reducing downwash from the PRGS stacks. Finally, the modeling scenarios and results are presented. The results reflect that downwash improvement or even elimination is possible through various combinations of stack height adjustments and/or stack merging.

#### 1. Background

The PRGS stacks were built in the late 1940s. Due to their proximity to Reagan National Airport, the Federal Aviation Administration limited the height of the stacks to 48.2 meters (158 feet) above ground to avoid causing a hazard to air navigation. The stacks are only 13 meters taller than the adjacent boiler building. As a result of this small stack to building height ratio, stack gas effluent experiences aerodynamic downwash caused by air flowing over and around surrounding structures. This turbulent air can transport stack gas effluent towards the earth's surface causing locally elevated pollutant concentrations.

The stack height necessary to avoid downwash is called the good engineering practice (GEP) height. For the PRGS stacks, this height has been calculated to be 88.2 - 97.1 meters above ground level, depending upon the particular stack. The 48.2 meter stacks are thus considerably shorter than GEP height. Taller stacks would experience less downwash, resulting in lower air pollutant concentrations than shorter stacks.

#### 2. Proposed Changes to Reduce Downwash

The FAA has performed an aeronautical study and determined that the PRGS stacks can be raised 50 feet without causing a hazard to navigation. The Clean Air Act and subsequent stack height regulations allow existing downwashing sources to receive modeling credit for raising stacks up to GEP height if downwash can be demonstrated through citizen complaints or fluid modeling. While downwash has been demonstrated and the FAA has approved the stack increase by 50 feet, the City of Alexandria, however, has opposed the stack raise.

The stack merge project is an alternative to taller stacks that is also designed to reduce the effects of downwash by producing higher plume rise. The higher plume rise allows the stack gas effluent to escape some of the highly turbulent air caused by surrounding structures. The stack merge project, as proposed, will not completely eliminate downwash but it will significantly reduce its effect.

Complete elimination of the downwash phenomenon can be achieved by constructing GEP stacks or by raising the stacks to less than GEP height and merging flue gas streams. Both of these alternatives are allowed under EPA stack height regulations.

### 3. Modeling Scenarios and Results

The attached figure shows the reduction in air pollutant concentration realized by raising stacks and/or by the stack merge project. Reductions in concentrations were computed by subtracting the lower concentrations from the base case concentration and then dividing by the base case concentration. The reductions are presented for Marina Towers separately from all other locations in order to show the large reductions at Marina Towers.

Modeling was performed for six cases.

- Case 1 (base case) is the five existing stacks with all units operating at maximum load;
- Case 2 is the same as Case 1 except all five stacks have been raised by 50 feet, the amount that the FAA would allow based on a recent ruling. Attachment \_\_\_\_ (FAA Approval Letter);
- Case 3 is the proposed stack merge project in which flue gases from Units 1 and 2 would exit through Stack 1 and flue gases from Units 3, 4, 5 and would exit through Stack 4. The stack diameter of Stack 1 would remain at 8.0 feet while the diameter of Stack 4 would be increased to 10 feet by removing the nozzle;
- Case 4 is the proposed stack merge project with Units 1 and 2 not operating;
- Case 5 is the stack merge project except the two merged stacks have been raised by 50 feet; and
- Case 6 is for the five existing stacks raised to GEP height (no merging), as allowed by EPA's Stack Height regulations but not allowed by the FAA and not allowed by the City.

All modeling has been performed at the same emission rate in Pounds per million British thermal unit. The modeling results are presented in terms of percent of Case 1 pollutant concentrations. Results apply to any pollutant emitted from the five stacks.

As shown in the figure, the largest improvements (smallest percent of base case) are on Marina Towers. All the cases produce concentrations on Marina Towers that are 50% or less of base case concentrations. This is because Marina Towers is closest to the centerline of the stack gas effluent. Case 2 (raising all five stacks by 50 ft), produces pollutant concentrations on Marina Towers that are only 38% of concentrations for the base case. Case 3, the proposed project, produces concentrations that are 41% of base case concentrations. Note that results for Case 3 are similar to Case 2, meaning that raising existing stacks by 50 feet without merging flue gas streams produces about the same concentrations as the stack merge project.

Case 4 (merged stacks raised by 50 ft) produces the lowest concentrations of all cases modeled. Predicted concentrations are only 10% of the base case. Case 5 (merged stack project, but with only Units 3, 4, 5 operating) produces concentrations that are 27% of the base case. Finally, Case 6 (all stacks at GEP height) produces concentrations that are only 18% of the base case. Note that the stack height regulations would not allow full dispersion credit for Case 4 because it produces concentrations

that are lower than would be produced from a GEP stack (Case 6). Therefore, should the stack merge project be approved along with a stack height increase, the stacks could be raised by 50 ft but modeling would assume a smaller stack height increase (say 35 feet) to comply with the Stack Height regulations.

#### 4. Conclusion

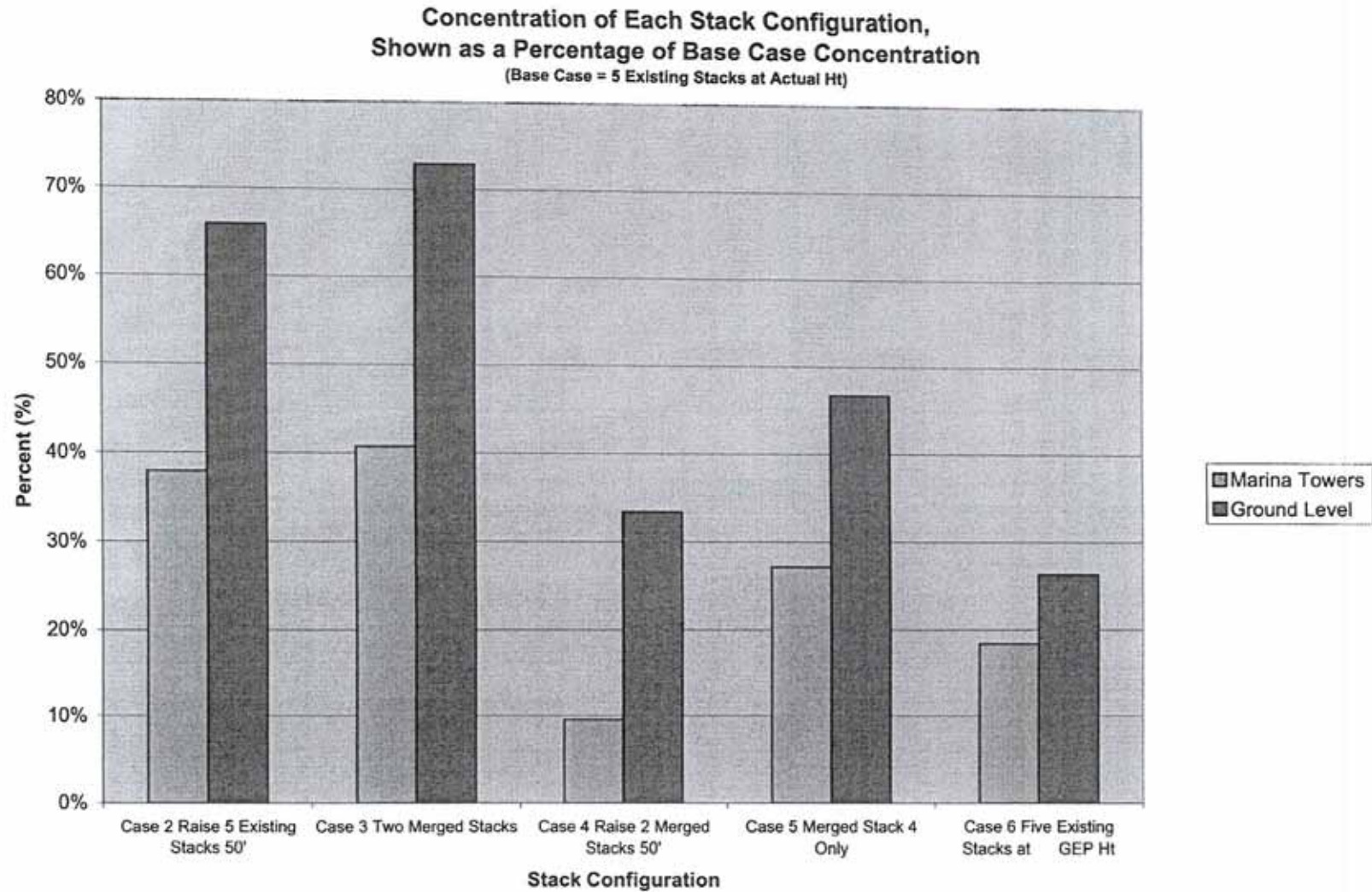
As reflected in the modeling results, the best scenario for maximizing decrease in downwash is to raise the PRGS stacks to GEP height. Alternatively, the scenarios presented in Cases 2 through 5 each present potential plans for decreasing downwash to various degrees. Case 1 remains the worst case situation. Through stack height adjustments and/or stack merging, the downwash phenomenon caused by the PRGS stacks can be reduced significantly or even eliminated.

Sincerely,



David Shea  
Senior Program Manager  
Air Quality & Engineering Services  
978-589-3113 (direct)  
[dshea@ensr.aecom.com](mailto:dshea@ensr.aecom.com)





**ENSR**

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May 4, 2007

Mr. David Cramer  
Mirant Corporation  
8301 Professional Place, Suite 230  
Landover, MD 20785

Subject: Analysis of PM<sub>2.5</sub> Measurements within 100 km of the Potomac River Generating Station

Dear Mr. Cramer,

Attached are four figures developed from measured PM<sub>2.5</sub> data for the months November, 2006 through January 2007. Data for all PM<sub>2.5</sub> monitors within 100 km of the Marina Towers PM<sub>2.5</sub> monitor are included. This spreadsheet was prepared on March 23, 2007. At that time there was data available only through January for Virginia and through December for Maryland.

Mirant has been operating a PM<sub>2.5</sub> monitor on the roof of Marina Towers since November 10, 2006. For the months of November through January, PM<sub>2.5</sub> concentrations at Marina Towers' monitor have ranged from a low of 4.03  $\mu\text{g}/\text{m}^3$  (December 1, 2007) to a high of 31.3  $\mu\text{g}/\text{m}^3$  (November 28, 2006). The 24-hour NAAQS is 35  $\mu\text{g}/\text{m}^3$ . Compliance is based on a comparison of the 6th highest 24-hour value at each monitor over a three year period.

Figure 1 (VA MD Chart) is a plot of the PM<sub>2.5</sub> concentrations for every day on which measurements were taken. The PM<sub>2.5</sub> concentrations for Marina Towers are shown as a blue triangle. The chart indicates that PM<sub>2.5</sub> concentrations vary on a regional basis. This means that much of the PM<sub>2.5</sub> measured at the monitors comes from outside the 100 km radius circle represented by these monitors. The concentrations vary depending upon which air mass is influencing them. Highest measured PM<sub>2.5</sub> concentrations generally occur during stagnant air masses when winds are calm or variable from the S to SW. For example, highest concentrations were measured on November 28, 2006. On November 26 - 29, 2006, winds were light and variable with mostly calm conditions. The few hours of recorded winds were from the south to southwest. Starting on November 30, an approaching weather system caused winds to increase to 5-12 mph, remaining from the south to SW. On December 1, a day with very low PM<sub>2.5</sub> measurements (see Figure 1), winds were from the south to SW at 10 - 25 mph all day until 8pm at which time a cold front passed through and winds shifted to the NW. Note that, even though winds on December 1 would have transported emissions from PRGS toward the Marina Towers monitor, measured PM<sub>2.5</sub> concentrations on that day at the Marina Towers monitor were very low (4.03  $\mu\text{g}/\text{m}^3$ ) and compare well with the 5.71  $\mu\text{g}/\text{m}^3$  average of all monitors on that day.

Figure 2 (Geometric Mean) is a plot of the geometric mean concentration for the three month period for each monitor. The geometric mean is the average used by EPA in calculating a long term average concentration for PM<sub>2.5</sub> and PM<sub>10</sub>. The figure shows that the mean for Marina Towers is well within the range of means of the other monitors. This indicates that the Marina Towers monitor does not appear to be receiving high impacts from the PRGS.

Figure 3: (24-Hour maximum Concentrations) is a plot of the maximum 24-hour PM<sub>2.5</sub> concentrations at each monitor for the three month period. The maximums range from 13.50  $\mu\text{g}/\text{m}^3$  to 41.90  $\mu\text{g}/\text{m}^3$ . The plot indicates that the maximum concentration at Marina Towers is well within the range of maximum measured concentrations in the region.

Dave Cramer  
5/4/2007  
Page 2

Figure 4: (Correlation): is a plot of the correlation coefficient between the 24-hour average  $PM_{2.5}$  concentrations at Marina Towers with each of the other monitors for the November - January period. In general, correlation refers to the mutual relationship between 24-hour concentrations measured at a monitor (Marina Towers) and the 24-hour concentrations measured at another monitor. A positive correlation means that daily concentrations at two monitors vary up or down together. A correlation coefficient of 1 means that there is a perfect linear relationship between concentrations at another monitor and concentrations at Marina Towers. A correlation coefficient of greater than 0.8 is very good and above 0.9 is excellent. As indicated in the Figure, there is very good to excellent correlation between 24-hour  $PM_{2.5}$  measurements at Marina Towers and 24-hour values measured at every other monitor within 100 km. At the bottom of the figure there is a correlation coefficient of 0.99 between daily values at Marina Towers and the average of daily values at all other monitors. This is a near perfect correlation.

Conclusions: The preceding figures demonstrate that the  $PM_{2.5}$  concentrations measured in the region are associated with sources outside the region and that PRGS is not causing high  $PM_{2.5}$  impacts at Marina Towers.

Sincerely,



David Shea  
Senior Program Manager  
Air Quality & Engineering Services  
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**Figure 1 - PM 2.5 Monitoring Data - November 2006 - January 2007**  
**Marina Towers vs. Virginia and 2006 Maryland State Run Monitors**  
**Within 100 km**

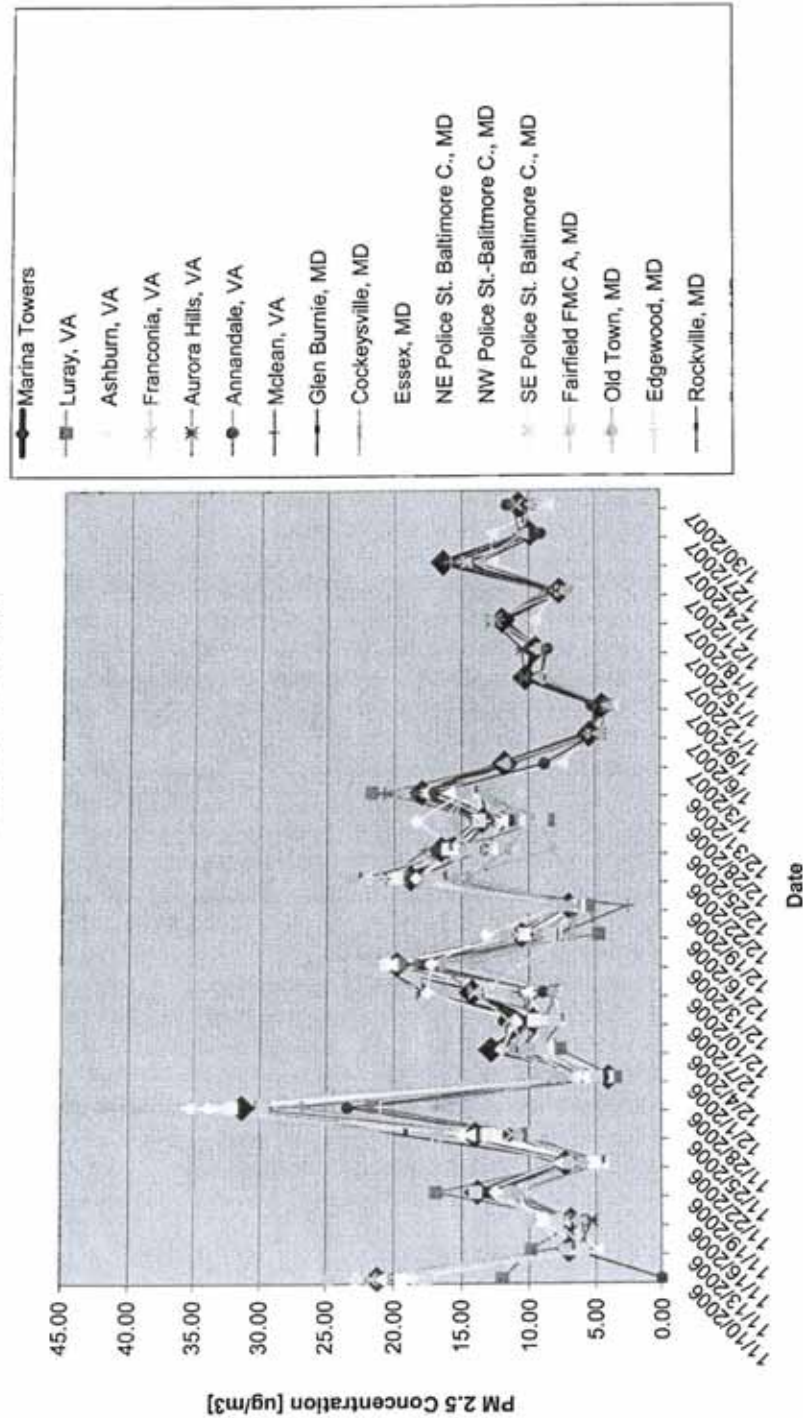


Figure 2 - Geometric Mean of PM 2.5 Concentrations  
November 2006 - January 2007

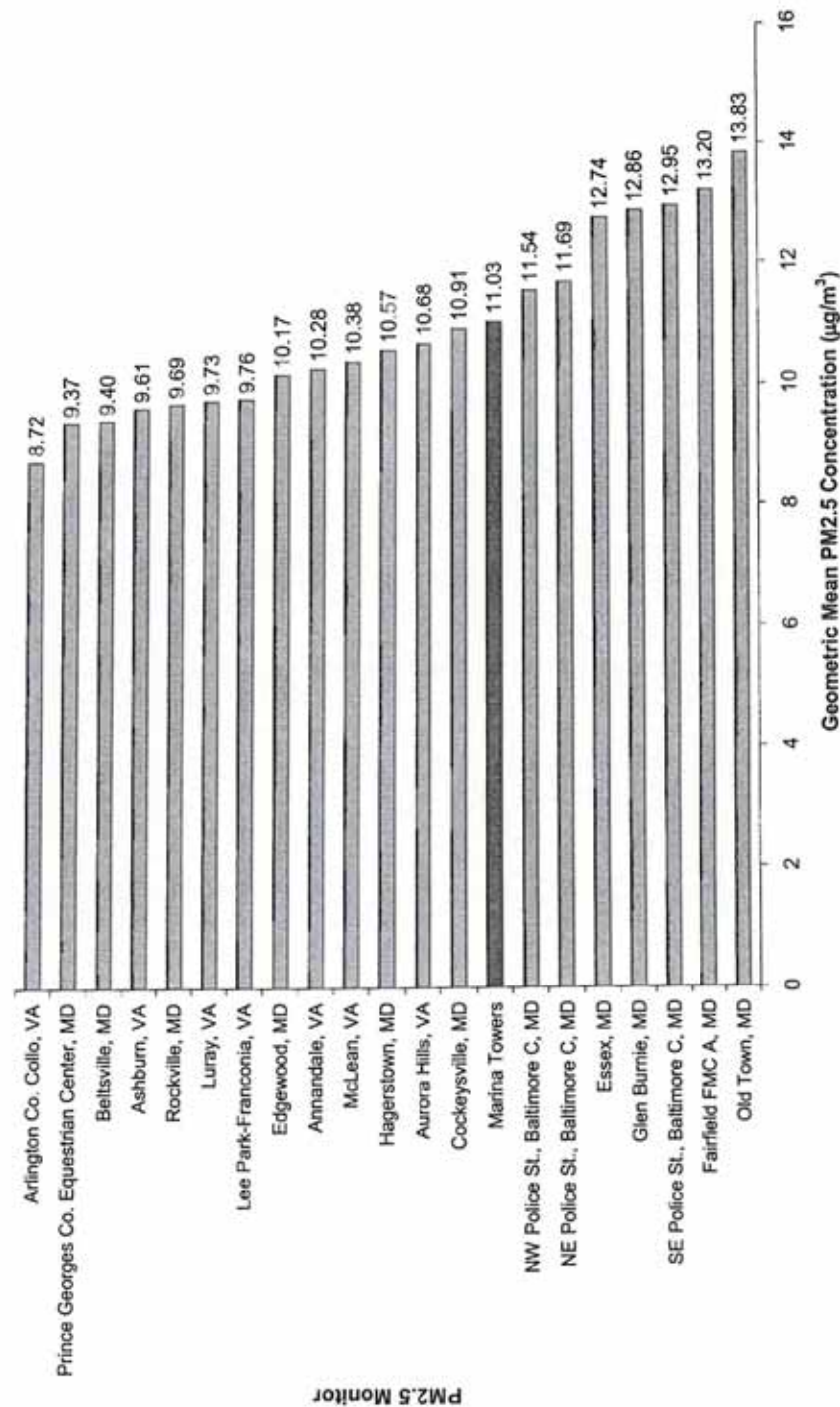
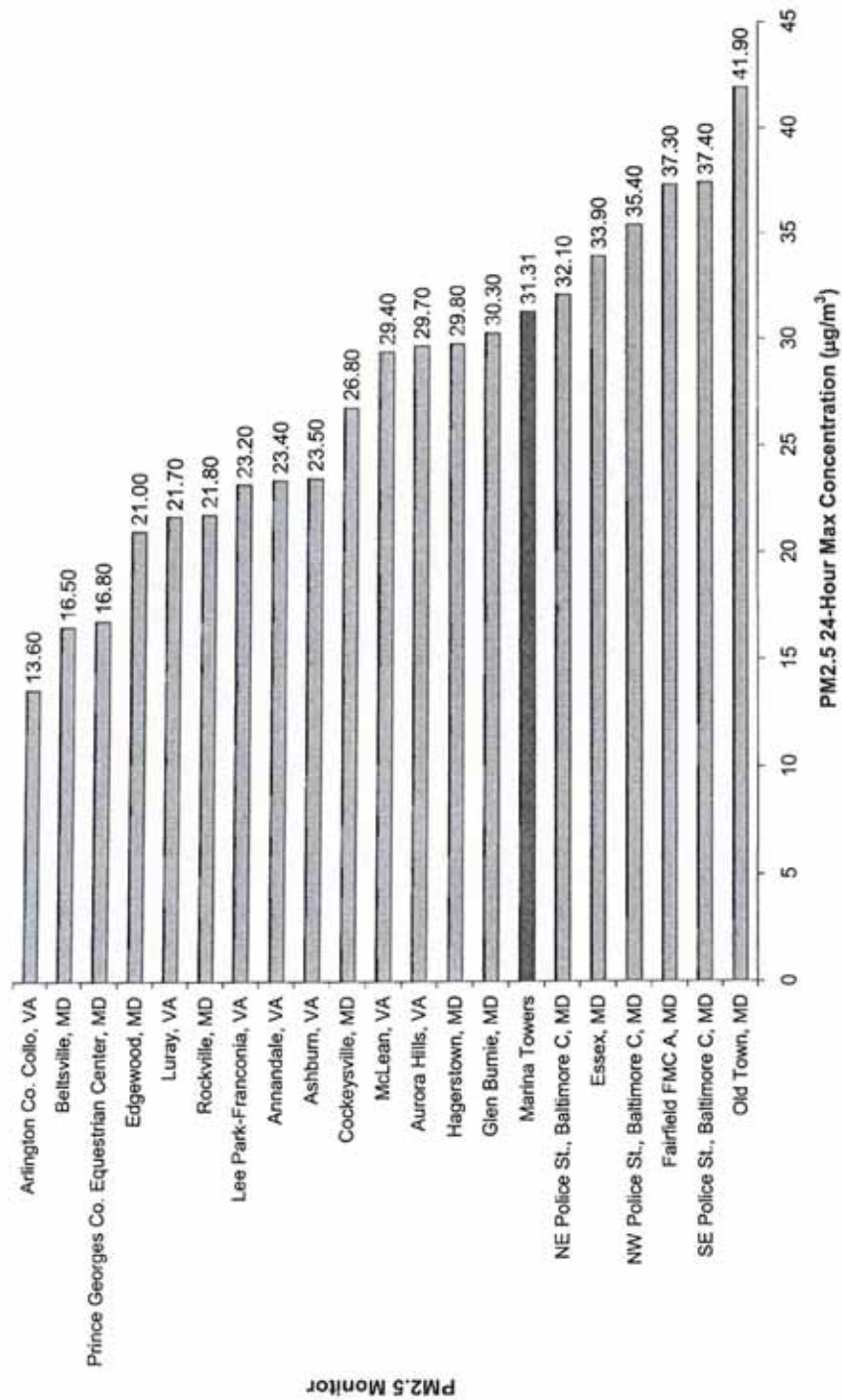
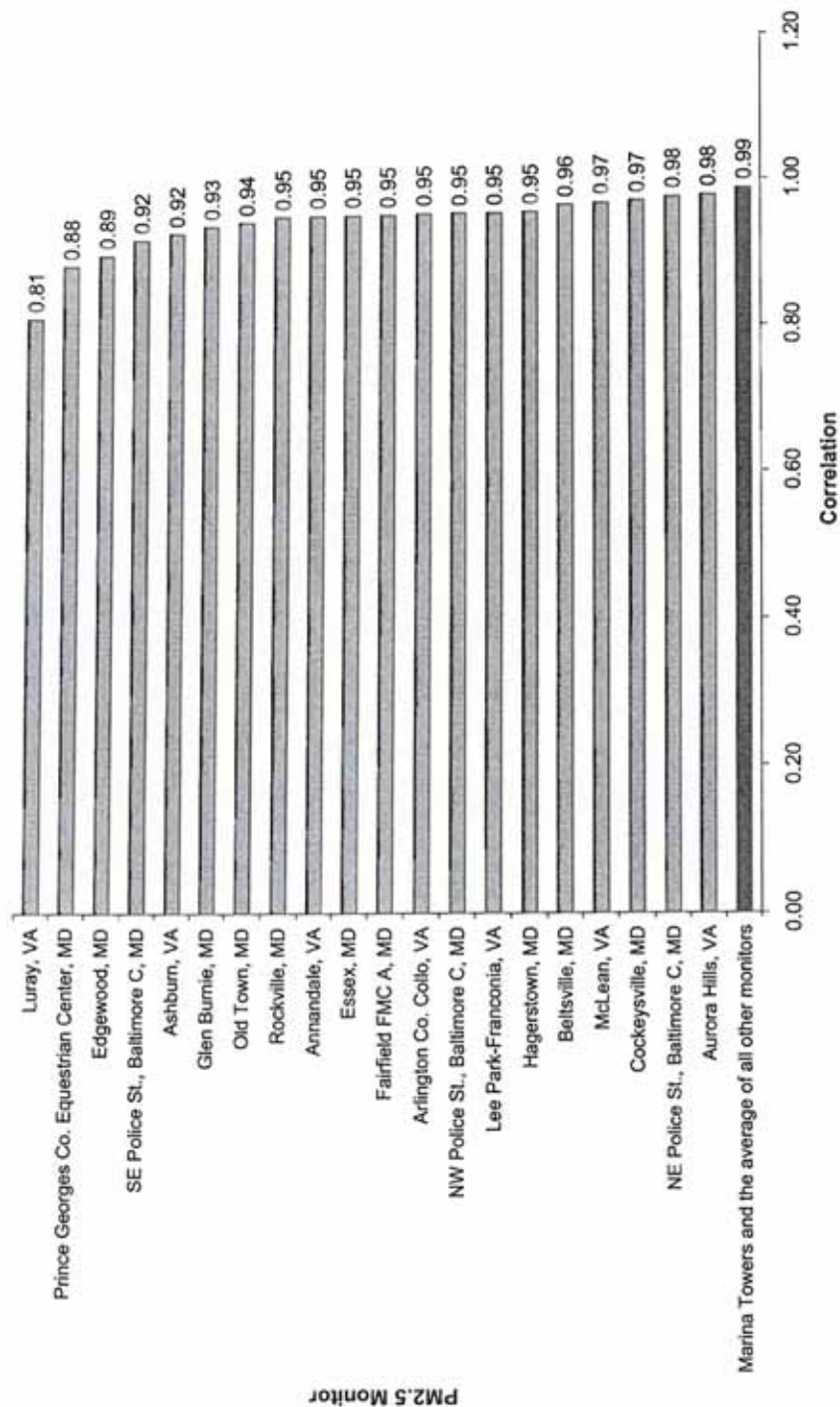


Figure 3 - PM2.5 24-Hour Maximum Concentrations  
November 2006 - January 2007





**Figure 4 - Correlation between Marina Towers and the Monitors Within 100 km  
PM 2.5 Monitoring Data - November 2006 - January 2007**



PM2.5 Monitor

# Potomac River Long-Term Opacity Averages

## SEMI-ANNUAL Averages

	C-1	C-2	C-3	C-4	C-5
2007 (Jan - Jun)	4.49	5.30	4.65	3.34	3.82
2006 (Jul - Dec)	4.78	5.35	3.58	2.39	2.77
2006 (Jan - Jun)	2.81	5.53	3.76	4.21	2.96
2005 (Jul - Dec)	2.45	3.40	2.38	2.11	1.42
2005 (Jan - Jun)	3.57	2.82	4.11	5.08	2.52
2004 (Jul - Dec)	2.52	2.20	4.61	3.77	2.51
2004 (Jan - Jun)	4.35	7.00	6.50	6.33	4.42

	C-1	C-2	C-3	C-4	C-5	Plant
06 Compliance w/ exempt	99.87%	99.92%	99.99%	99.90%	100.00%	99.95%
05 Compliance w/ exempt	99.99%	99.97%	99.95%	99.84%	100.00%	99.95%

Wynn L. Eberhard\* and W. Alan Brewer  
NOAA Environmental Technology Laboratory

Roger L. Wayson  
University of Central Florida

## 1. INTRODUCTION

The exhaust from jet engines on aircraft is one source of air pollution (Fig. 1). Section 2 summarizes the pertinent characteristics of the jet engine exhaust plumes. This paper discusses two ways in which lidar can contribute to understanding the air quality effects from these emissions. One is measurement of the initial growth of the exhaust plume due to high velocity and shear and rise due to its elevated temperature. We observed the behavior of jet engine exhaust plumes from many aircraft during the first few tens of seconds after they commenced takeoff roll by detecting enhanced backscatter from particles emitted by the engines. The lidar system, sampling strategy, and analysis are described in Sections 3 and 4. The results are being used as input to at least one air quality model.



Fig. 1. Particulates in the exhaust of an aircraft just after take off.

Secondly, the potential for using lidar to determine the emission rates of soot from aircraft engines is addressed in Sections 5-7. Soot emissions contribute to the PM<sub>2.5</sub> in the area of airports. During our measurements of plume geometry it was obvious that newer-generation aircraft on the whole produced less backscatter. This would seem to correspond with the aircraft industry's attempts to make engines more efficient and less polluting. The lidar also tended to detect stronger signal when the exhaust plume was

obvious to the eye. This experience suggested that a calibrated lidar might be able to remotely infer soot concentrations and emission rates from aircraft jet engines. Soot measurements have been performed *in situ* (D. W. Fahey and U. Schumann in IPCC 1999 pp. 72-76), some on the ground (e.g. Hagen et al. 1992, Petzold et al. 2003, Nyeki et al. 2004) and others at altitude by chase aircraft (e.g., Hagen et al. 1996, Petzold et al. 1999). Petzold et al. (1999) estimated the emission index of soot  $EI_m$  (mass emitted per mass fuel consumed) of the world's fleet of aircraft to be  $0.04 \text{ g kg}^{-1}$ , but the uncertainty in this is a factor of 2 at best (J. S. Lewis and R. W. Niedzwiecki in IPCC 1999 p. 236). Aircraft operating on or near the ground at airports experience a wide range of power settings and less than optimal conditions for jet engines, so emission rates that impact air quality are poorly known. A remote sensing method that could relatively inexpensively observe soot emissions from many types of aircraft over their range of operating conditions could greatly reduce this uncertainty.

## 2. CHARACTERISTICS OF JET ENGINE EXHAUST

A brief description of the characteristics of jet engine exhaust provides the context for discussion of lidar measurements. Compressor blades in the front of jet engines compress the intake air. The air enters the combustor section where it is mixed with fuel and burns. Many commercial aircraft engines have turbofan engines in which most of the intake air passes to the side of the combustor. The exhaust from the combustor directly drives the turbine, indirectly drives the compressor through gearing, and, in the case of turbofan engines, drives the large fan that is responsible for most of the thrust. The thrust of hot gas out the exit nozzle also helps propel the aircraft forward. The initial exhaust has a core of hot, high-velocity gas from the combustor, coaxially surrounded by lower-speed bypass air.

Fuel burning combines the carbon and hydrogen atoms in the fuel with oxygen to generate energy and in the process forms  $\text{H}_2\text{O}$  and  $\text{CO}_2$ . The combustor exhaust contains particles of carbon, unburned fuel, and inorganic matter that was also present in the fuel. The carbon, or soot, is the primary non-volatile component, but the exhaust also contains other nonvolatiles including metals, sulfates, and nitrates.

The exhaust plume grows in crosswise dimension, and the velocity of the air in it decreases with distance behind the engine. The temperature difference between the exhaust and the ambient air is thought to be the

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Corresponding author address: Wynn L. Eberhard, R/ETL2-NOAA, U.S. Dept. of Commerce, 325 Broadway, Boulder CO 80305; 303-497-6560; e-mail: [wynn.eberhard@noaa.gov](mailto:wynn.eberhard@noaa.gov).



primary reason for plume rise. The push of exhaust air against the ambient air and turbulence generated by velocity shear contribute to this expansion. The turbulence causes some mixing of the combustor exhaust, bypass air, and ambient air. The air velocity in the plume depends mainly on the distance behind the aircraft, the thrust of the engines, and the aircraft speed. Speeds that are significantly higher than the motion of the ambient air can extend several hundred meters behind a large aircraft at takeoff power.

The temperature of the exhaust plume decreases with distance behind the engine through radiation, expansion, and mixing with ambient air. At any distance, the per cent difference of plume temperature compared to ambient temperature in degrees Kelvin is typically much less than the % difference of exhaust air speed compared to ambient wind speed.

As the plume ages, the volatile components, such as hydrocarbons, also begin to create small aerosol particles. Deposition of sulfuric acid and hydrocarbons on the soot particles also takes place, increasing their mass to some extent. Some of the particles coagulate, forming larger particles from multiple smaller ones.

### 3. LIDAR DESCRIPTION

A lidar transmits a pulse of light, which undergoes scattering and absorption as it propagates away from the system. A small part of the scattered light travels straight back to the lidar, where it is gathered and focused by a telescope onto a detector. The detector voltage is digitized as a function of time, and recorded as a function of range from the lidar.

After calibration and other factors are applied, the lidar signal can be expressed as

$$P = C [\beta_p(R) + \beta_m(R) + \beta_a(R)] \times \exp \left\{ -2 \int_0^R [\sigma_p(R') + \sigma_m(R') + \sigma_a(R')] dR' \right\} \quad (1)$$

where  $C$  is the calibration factor,  $R$  is range,  $\beta$  is volumetric differential backscatter cross-section,  $\sigma$  is volumetric extinction coefficient, and subscripts  $p$ ,  $m$ , and  $a$  refer to particles in the exhaust plume, air molecules, and ambient aerosol particles, respectively. Both scattering and absorption contribute to the extinction coefficient.

The laser we selected for jet exhaust measurements was a Nd:YAGx3 transmitting at 355-nm wavelength. Eyesafe operation was easy to achieve in the ultraviolet with simple precautions. The light is invisible, so there was no interference with pilot vision night or day. When the beam strikes a hard target it fluoresces about as brightly as if illuminated by a small penlight, so it is best to keep the beam scanning at night to avoid raising the curiosity of the public as well as help ensure eyesafety. The 355-nm wavelength is also close to optimum for detecting the particles in the jet exhaust in the presence of scattering from molecules and from ambient particles. We used our OPAL (Ozone Profiling

Atmospheric Lidar, Fig. 2), but operated only with the "aerosol channel" (Table 1). The lidar could scan in elevation angle but had a fixed azimuth. Real-time data displays (Fig. 3) helped the experimenters optimize sampling strategy, but raw data were recorded on DAT tapes.



Fig. 2. Lidar system for plume geometry measurements. The enclosure on top contained the elevation-scanning mirror.

Parameter	Value
Wavelength	355 nm
Pulse energy	8 mJ
Pulse repetition rate	10 s <sup>-1</sup>
Pulse length	10 ns
Range gate length	5 m
Telescope diameter	0.2 m
Elevation angle resolution	0.2°

Table 1. Specifications of lidar used for plume geometry measurements.

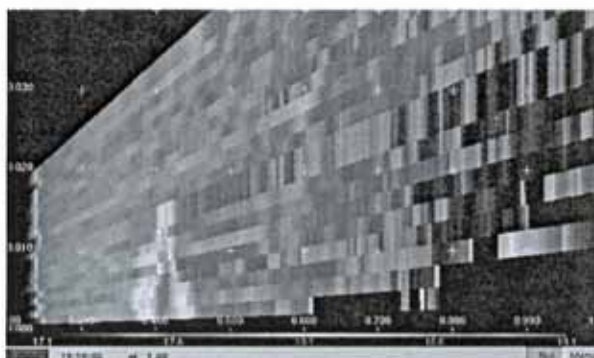


Fig. 3. Example false color display of backscatter from the ambient air (greens) and a jet exhaust (browns). The vertical scale is expanded about 10 times more than the horizontal.

### 4. EXHAUST PLUME GROWTH AND RISE

The lidar observed plume geometry during 17-24 May 2001 at Los Angeles International Airport. The lidar was positioned about 400 m from Runway 25R and scanned in a vertical plane oriented nearly



perpendicular to the runway centerline. Data acquisition began as each aircraft commenced takeoff roll and passed through the scan plane. The lidar automatically repeated vertical sweeps until the operator halted data acquisition because of poor data quality. Causes for degradation of data quality included loss of contrast against the signal from the ambient air, growth of the plume so the top of the plume obviously rose above the top of the scan, or the next aircraft reached the scan plane. Each sweep lasted about 5 s.

The majority of the aircraft generated plumes with adequate contrast, and these were used in the ensuing analysis. Other aircraft created very weak or invisible plumes relative to ambient. This did not mean particle emissions were zero, but rather that the backscatter from the emitted particles was about the same as from the ambient air. Some plumes in very hazy conditions were "negative", i.e., had less backscatter than the ambient. This was presumably caused by a combination of volatilization of the ambient particles passing through the engine and low particle emissions. Measurements were performed on more than 900 aircraft, and 4138 sweeps for 359 aircraft were retained after initial processing and quality control. Plumes from 21 types of aircraft were successfully detected.

Video cameras recorded the scan area to document aircraft position and the time the aircraft commenced takeoff roll. Binocular-equipped spotters reported aircraft type, airline, and tail number to the operator, who recorded these in the log sheet. These data were later matched with departure logs obtained from the airport to ensure accuracy and to identify the type of aircraft when tail numbers were not available at night.

The first stages of lidar data postprocessing used common methods. DC signal levels from background light and electronic offsets were removed based on pretrigger data. Adjustments for the pulse energy monitor and the range-squared correction were applied, producing  $P$  as given in (1).

The remainder of the processing was designed to reveal the geometry of the plume. Data from each sweep were displayed in range-angle coordinates with an approximate value of  $\sigma_m + \sigma_a$  applied to flatten out the signal in range, and an analyst selected the sweeps with adequate data for further processing. Data from each selected sweep were displayed again later, and the analyst designated three regions in range: the range gates containing the enhanced signal from the jet engines (plume region), ~20 range gates with signal from ambient air closer to the lidar (near region), and ~20 range gates with signal from ambient air on the far side of the plume (far region). Extinction by plume particles and along-beam inhomogeneity in the ambient aerosol were approximately compensated by finding the ratio of the average signal in each of the near and far regions and applying an average "extinction coefficient" through the plume region to make the far region average the same as in the near region. This procedure is not mathematically rigorous, but it accounted for natural conditions in a simple and effective way for

revealing the plume geometry. The result was approximately

$$P_2 = C [\beta_p(R) + \beta_m(R) + \beta_a(R)] \quad (2)$$

The program then calculated

$$p = \beta_p(R) / [\beta_m + \beta_a] \quad (3)$$

by using the signal in the near region to determine the average value of  $\beta_m + \beta_a$ . The calibration constant disappears in (3), so there was no need to calibrate the lidar.

The data in polar coordinates (range and elevation angle) were interpolated to a rectangular grid (height above ground and horizontal distance from the lidar) and digital and graphical output generated (Fig. 4). A simple match of a two-dimensional Gaussian was made to each gridded sweep, from which the plume rise and vertical and horizontal dispersion parameters were calculated. The turbulent growth and rise is a random process, so the sweep with the second-highest rise was selected for each aircraft and used to conservatively define "final" plume rise and dispersion for that takeoff.

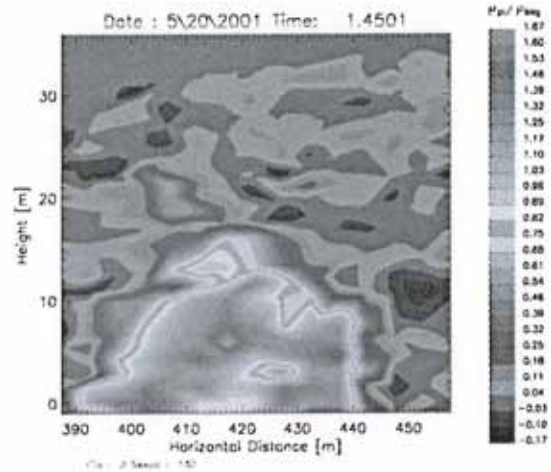


Fig. 4. Example of gridded plume backscatter expressed as a ratio to ambient backscatter.

Statistical analyses were performed for various factors that might affect plume behavior, such as size of aircraft, fuselage- or wing-mounted engines, and atmospheric stability. Although the results suggested trends due to some of these factors, most were not statistically significant in the current data set. For example, atmospheric stability will likely reduce plume rise and vertical dispersion, but there were few samples under such conditions. Horizontal plume size tended to be greater for larger aircraft with wing-mounted engines, presumably because of the separation of initial exhaust locations. Importantly (and perhaps surprisingly), the rise and vertical dispersion of exhaust from large



commercial aircraft were only slightly greater than from smaller commuter aircraft, and the differences were statistically insignificant.

Wayson et al. (2003) recommended the following average plume parameters for input to air quality models:

- Plume height above ground: 12 m
- Vertical dispersion coefficient: 4.1 m
- Horizontal dispersion coefficient: 10.5 m

The Emissions and Dispersion Modeling System used by the U.S. Federal Aviation Administration for evaluation of aviation emission sources from proposed airport projects now uses these values, which are larger than assumed before (Hall et al. 2003).

Additional measurements and research should be able to define the effect of various parameters with statistical significance. Measurements in stable conditions will be particularly important.

## 5. OPTICAL SIGNATURES FROM SOOT

Scattering calculations at 355-nm wavelength allow examination of the potential for lidar estimation of soot particle concentrations and emission rates. The focus is on particle mass rather than number concentration because of the U.S. National Ambient Air Quality standards are in terms of mass. Although there is interest in numbers as well, the correlation of optical parameters with number concentration is very poor. We seek a relationship between soot mass concentration  $c$  and the volumetric backscatter or extinction cross section of soot, or  $\beta_s$  and  $\sigma_s$  respectively. The calculations used values for refractive index, density, and size distributions based on reports of other studies. The Rayleigh-Mie code of Bohren and Huffman (1983) was used, which assumes homogeneous, spherical particles. Soot particles usually are not truly homogeneous spheres, so actual scattering and extinction may deviate from these calculations. However, because the particles are highly absorbing and results are normalized to mass, we anticipate the actual optical behavior will not deviate grossly from the calculations.

Horvath (1993) and Marley et al. (2001) summarized a number of earlier values used and measurements of the complex refractive index  $n = n_r - n_i$  of soot, elemental carbon, and black carbon. The  $n$  of these highly absorbing materials is difficult to measure. Most of these references do not report the density  $\rho$  of the carbon in the particles. Soot particles are usually a mixture of carbon with air in proportions that depend on the formation process. Horvath (1993) assumed  $n = 2.0 - 1.0i$  for  $\rho = 2.25 \text{ g cm}^{-3}$  and assumed a simple mixing rule to obtain  $(n_r - 1) = n_i = \rho / (2.25 \text{ g cm}^{-3})$  for less dense particles. We used this method for  $\rho = 1.00, 1.25, 1.50, 1.75, 2.00$ , and  $2.25 \text{ g cm}^{-3}$ , although values for soot from aircraft jet engines are most likely limited to the low or middle part of this range.

Lidar backscatter for these refractive index values at 355-nm wavelength can be divided into three regimes according to particle size. Particles with diameter  $d$

smaller than  $\approx 50 \text{ nm}$  are in the Rayleigh regime; those with  $d$  larger than  $\approx 200 \text{ nm}$  are in the Mie regime; and those with diameters between are in the "first peak" part of the Mie regime. When normalized to particle mass,  $\beta$  and  $\rho$  both exhibit some dependence on  $n$  at all particle sizes.

In the Rayleigh regime,  $\beta_s$  scales with  $d^6$  or with  $m^2$ , where  $m$  is the mass of the particle. Extinction in the Rayleigh regime is dominated by absorption, and  $\sigma_s$  scales as  $d^3$  so that  $\sigma_s$  is proportional to particle mass if  $\rho$  is constant.

For  $d > 200 \text{ nm}$  in the Mie regime, both scattering and absorption are significant in  $\sigma_s$ . The extinction coefficient depends almost entirely on the cross-sectional area of the particle independent of refractive index,  $\sigma_s$  scales as  $d^2$  irrespective of  $\rho$ . The behavior of  $\beta_s$  in this regime is more complicated, exhibiting a damped oscillation as  $d$  increases. When the oscillations are smoothed by a running average in  $d$ , then  $\beta_s$  increases as  $d^2$  or as  $m^{2/3}$  when  $\rho$  is held constant.

In the "first peak" part of the Mie regime,  $\beta_s$  normalized to particle mass peaks at about  $d = 115 \text{ nm}$ . Scattering becomes important in  $\sigma_s$  as  $d$  increases above  $50 \text{ nm}$ , and  $\sigma_s$  normalized by particle mass peaks at  $d \approx 150 \text{ nm}$ .

D. W. Fahey and U. Schumann (in IPCC 1999 pp. 72-76) summarize earlier *in situ* measurements of number size distributions of soot from jet engines, including those of Hagen et al. (1992, 1996) and Petzold et al. (1999). More recent measurements were reported by Petzold et al. (2003) and Nyeki et al. (2004). The size distributions are usually lognormal in shape with count geometrical mean diameters (CGMD) of typically  $35 \text{ nm}$  but ranging over  $20\text{--}60 \text{ nm}$ . The geometric standard deviations (GSD) are typically  $1.65$  but range over  $1.55\text{--}1.72$ . In this study we use the corresponding mass distributions, which are lognormal with the same GSD, but with mass geometrical mean diameters (MGMD) typically  $70 \text{ nm}$  but ranging over  $40\text{--}120 \text{ nm}$ .

The  $\beta_s$  and  $\sigma_s$  were calculated for combinations of MGMD, GSD, and  $n$  and, using the corresponding value of  $\rho$ , normalized to  $c$ . The dependence on GSD was much weaker than on MGMD and  $n$ , so we show here only results for GSD = 1.65.

The  $\beta_s / c$  results for lidar backscatter are shown in Fig. 5. Ideally,  $\beta_s / c$  would be independent of MGMD and  $n$ , so  $\beta_s$  measured by lidar would reveal the mass concentration  $c$  independent of size distribution or refractive index. The dependence on MGMD is relatively weak over MGMD =  $100 \pm 25 \text{ nm}$ . However,  $\beta_s / c$  decreases significantly outside these limits, especially as MGMD becomes smaller. This indicates that separate information about MGMD must be obtained for accurate estimation of  $c$  from measurements of  $\beta_s$ . A functional relationship between  $E_{lm}$  and MGMD may well exist, which might be ascertained with limited *in situ* measurement and applied in the analysis of lidar data. The dependence on  $n$  is smaller than on MGMD and would become a relatively minor source of error if the appropriate values of  $n$  and corresponding  $\rho$  can be established for jet engine exhaust.



The dependence of  $\sigma_s/c$  on MGMD (Fig. 6) is much less than it is for  $\beta_s/c$ .  $\sigma_s$  also depends on  $n$  somewhat less than  $\beta_s$  does. If  $\sigma_s$  can be measured in jet exhaust plumes with accuracy comparable to  $\beta_s$ , it would be a superior method.

The lidar ratios  $\sigma_s/\beta_s$  for these size distributions are shown in Fig. 7. Especially noteworthy is the accelerating increase in  $\sigma_s/\beta_s$  as  $d$  decreases below 60 nm. This suggests that simultaneous measurement of  $\sigma_s$  and  $\beta_s$  from the jet exhaust could reveal small MGMD with an accuracy limited by knowledge of  $n$  and measurement accuracy. Another possibility for lidar measurement of small MGMD is simultaneous measurement of backscatter at two separate wavelengths. If the refractive index is the same at both wavelengths (a good approximation), then the curves in Fig. 5 shift along the horizontal axis in proportion to the difference from 355 nm. The feasibility of using two wavelengths and of measuring  $\sigma_s/\beta_s$  for providing information on MGMD should both be explored if lidar is to be used extensively for measurement of soot emission rates.

If  $\beta_s$  is to be measured, the lidar must be calibrated to obtain the value of  $C$ . Standard methods can be employed to achieve this calibration. For measurement of  $\sigma_s$ , a calibration is not required. A method that can be applied to measure plume extinction (Eberhard et al. 1987) is to first account for extinction in the ambient air by adjusting  $\sigma_a$  to make  $P$  in (1) constant in range in approximately homogeneous ambient conditions. The ratio of backscatter from the ambient air on opposite sides (near and far) of the plume provides the optical depth through the plume. With an assumption of constant extinction-to-backscatter ratio, the extinction coefficient along the lidar beam in the plume region can be calculated.

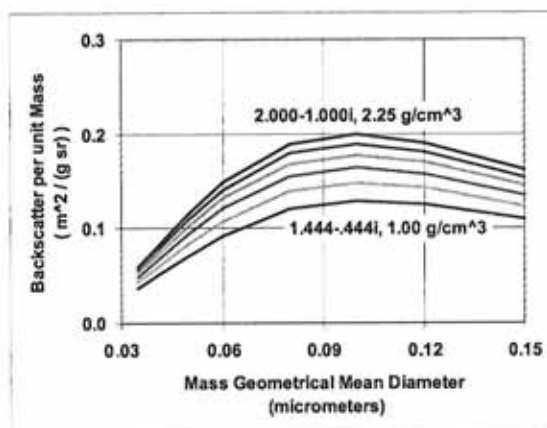


Fig. 5. Lidar backscatter per unit mass  $\beta_s/c$  at 355-nm wavelength versus MGMD for lognormal size distributions of spherical soot particles with GSD = 1.65 at the indicated values of refractive index  $n$  and density of the particles (in  $\text{g cm}^{-3}$ ). The unlabeled curves are for steps in density of  $0.25 \text{ g cm}^{-3}$  and corresponding change in  $n$ .

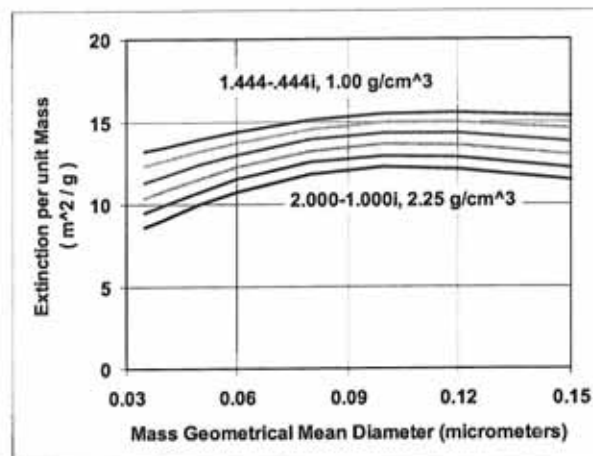


Fig. 6. As in Fig. 5 except for extinction  $\sigma_s/c$

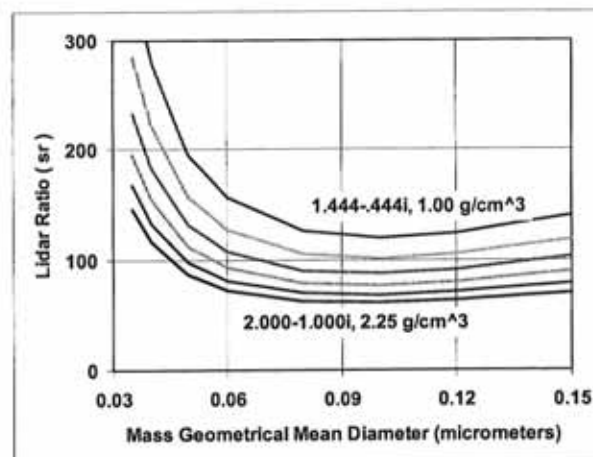


Fig. 7. As in Fig. 6 except for lidar extinction-to-backscatter ratio  $\sigma_s/\beta_s$ .

## 6. CONCENTRATION IN EXHAUST CORE

Next to be considered are lidar sampling strategies to obtain soot emission rates from measurements of  $c$ . One approach would be to measure  $\beta_s = \beta_p$  in the core of the exhaust from the combustor. The fuel consumption rate and air-to-fuel mixture are usually quite well known for each engine's operating configuration. Combining these with concentrations inferred from the lidar data would yield the mass emission index  $EI_m$ , i.e., the fraction by mass of fuel converted to soot. The density of the air in the core should be considered as well, for it determines  $\beta_m$ , which must be subtracted to isolate the backscatter from the particles.

If extinction is large enough, it might be determined by measuring backscatter in range gates on either side of the exhaust to obtain the optical depth across the plume.



Measurement of concentrations in the core will place heavy demands on the design of the lidar. The exhaust must be sampled close (<10 m, and perhaps ≈ 1m) behind the nozzle before much turbulent mixing occurs. A range resolution of ≈ 10 cm or finer is desirable to obtain at least one data point only in the core. This would require a special short-pulse laser and very fast detector and digitizer. The transverse resolution should be correspondingly small, which restricts the diameter of the beam and requires high angular precision in pointing or scanning. The limits on resolution might be relaxed if the diameter of the jet exhaust is known independently and the scattering properties of the surrounding air (bypass if a turbofan and ambient air) are known. The coarser the spatial resolution, the larger are the uncertainties in the accounting for these factors. The proximity of the aircraft structure (wings and fuselage) imposes limits on how much the lidar's spatial resolution can be expanded for core measurements.

## 7. FLUX AND EMISSION RATE

Another approach would be to scan the lidar in elevation angle, as was done for plume geometry, to determine the flux of soot through the plane of the scan. The flux is given by:

$$F = \int_{y,z} c(y,z) \mathbf{v}(y,z) \cdot \mathbf{i} \, dydz \quad (4)$$

where  $y$  and  $z$  are coordinates in the plane,  $c$  is the mass concentration of soot,  $\mathbf{v}$  is the velocity vector of air moving the soot, and  $\mathbf{i}$  is the unit vector normal to the flat scan plane with  $\mathbf{i}$  pointed to the side opposite the aircraft. If  $\theta$  is the angle between the wind direction and the plane's surface, then  $\mathbf{v} \cdot \mathbf{i} = v \sin\theta$ , where  $v$  is the speed of the air. For a static aircraft and assuming no change in soot particles between emission and measurement,  $F = Q$ , where  $Q$  is the emission rate.

If the aircraft is moving with velocity  $\mathbf{V}$ , the concentration of particles in the air changes, and the relationship between emission rate and flux measurement becomes

$$Q = \int_{y,z} \left[ 1 - \frac{\mathbf{V} \cdot \mathbf{j}}{v} \right] c(y,z) \mathbf{v}(y,z) \cdot \mathbf{i} \, dydz \quad (5)$$

where  $\mathbf{j}$  is the unit vector of wind direction, i.e.,  $\mathbf{j} = \mathbf{v}/v$ . In this expression  $\mathbf{V}$  is for the time of emission, so if  $\mathbf{V}$  is changing due to aircraft acceleration, the transport time from emission to the scan plane should be considered for best accuracy in  $\mathbf{V}$ .

$c(x,y)$  could be inferred from lidar profiles of  $\beta_p$ . Because of mixing with bypass and ambient air,  $\beta_p$  and  $\beta_s$  aren't necessarily identical. Described below are schemes to account for the difference and also to obtain  $\mathbf{v}$ .

### 7.1 Flux in dynamic exhaust plume

One location a lidar could scan for flux measurement is in a plane roughly perpendicular to the aircraft heading and within a few hundred meters behind

the aircraft, where the exhaust is still dynamic. The following additional information is required to complete the flux measurement:

- 1) the profile of exhaust velocity  $\mathbf{v}(x,y)$  over the scan plane, which could be obtained by measurements or models. The use of models confirmed by measurements would be the most practical. Models have been developed to describe the safety environment for ground operations (e.g. at [www.boeing.com](http://www.boeing.com)). For our purpose, models should consider the type of engine and aircraft, power setting, aircraft speed, and the ambient wind.
- 2) the profile of air temperature  $T(x,y)$  in the plume over the scan plane. This is needed to determine the density of the air to calculate a correct  $\beta_m$  and  $\sigma_m$ . Modeling supported by measurements, analogous to that for exhaust velocity, would seem to be the best approach.
- 3) the contribution to backscatter or extinction in the exhaust plume caused by mixing of particles in the ambient air into the plume. It is reasonable to assume that particles ingested into the combustor are volatilized. The fate of ambient particles in the bypass air is less obvious and would need to be understood. Models used for #1 might provide the amount of mixing. The plume dimensions measured by the lidar would provide an independent check for consistency. The higher the  $El_m$  and the lower  $\beta_p$ , the less need for accuracy in understanding the fate of the ambient particles.

### 7.2 Flux by transport in the ambient wind

The complications of #1 and #2 in Sec. 7.1 could be eliminated by scanning the lidar farther away from the aircraft where the exhaust dynamics have decayed and the ambient wind transports the plume. Then  $\mathbf{v}$  is the same as the ambient wind, which can be easily measured. Temperature enhancement in the plume at such distances would be insignificant. However, understanding the degree of mixing with ambient air will be important.

Changing the orientation of the scan plane may be optimum for measuring emission rates, especially if observation of extinction is part of the strategy. Consider orienting the scan roughly parallel to the runway and offset on the downwind side. As aircraft take off, the plume will drift almost sideways through the scan plane unless the wind direction is almost exactly parallel to the scan plane. The high exhaust velocities will decay away before reaching the scan plane, or at least will be much less important because they are approximately parallel to it. The path length of the lidar beam through the plume will be much greater than for perpendicular scans, so the plume's optical depth will be larger and easier to measure. The degree of mixing of ambient air could be evaluated by comparing the plume volume measured by the lidar to the volume of air passing through the engine. Although scans roughly perpendicular to the plume's direction of movement are best for measuring plume geometry, a nearly parallel geometry could be far superior for measuring emission rates.



## 8. CONCLUSIONS

A lidar operating at 355-nm wavelength was safely able to measure the geometry of exhaust plumes from a wide variety of commercial jet aircraft. Data from that experiment have been used to improve an air quality forecast model. Additional measurements would be required to increase the statistical data sample to determine the dependence of initial plume rise and dispersion on aircraft thrust, the location of the engines, and atmospheric stability.

Anecdotal evidence from the plume geometry measurements and simulations of backscatter and extinction in this paper indicate that an ultraviolet lidar could also measure concentrations of soot in the exhaust plume and use sampling strategies with auxiliary information to infer the mass emission rates from the engines. A more definitive understanding of each of the following would improve the accuracy of emission rate measurements:

- 1) density and refractive index of soot particles from aircraft jet engines, both primary and aggregated;
- 2) rate and amount of deposition of plume constituents such as hydrocarbons and sulfuric acid on the soot particles;
- 3) effect of nonspherical particles on backscatter and extinction;
- 4) for flux measurements in the dynamic plume, verified models that give the velocity and temperature structure of the plume and amount of mixing of ambient air;
- 5) and, for flux measurements by transport by the ambient wind, evaluation of how much ambient air is mixed into the exhaust from the engine.

Mass emission rates from jet engines during airport operations are currently known only within a factor of a few, so high accuracy is not necessary for such measurements to be useful.

Lidar scattering from ambient particles is a source of interference that can be accounted for, at least to some extent. However, future observations would benefit from a location and time when concentrations of ambient particles are low, i.e., when visual range is large.

One important advantage of lidar for measuring jet exhaust is that data can be acquired remotely during real-life conditions. The measurements are entirely noninvasive and do not interfere with airport operations. Lidar can sample a large number and variety of aircraft with relative ease to examine how exhaust characteristics vary among types of aircraft.

### Acknowledgments

Thanks to Los Angeles World Airports (LAWA) and the FAA and DOT for funding support. Julie Draper of FAA and Gregg Fleming of DOT provided important encouragement and assistance. Valuable help for the plume geometry project was provided by Bob Holden of LAWA, John Pehrson of Camp Dresser & McKee Inc., and Richard Marchbanks, Ann Weickmann, Joanne

George, and Christoph Senff of the Environmental Technology Laboratory.

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**From:** Paylor,David <dkpaylor@deq.virginia.gov>  
**Sent:** Wednesday, June 6, 2007 3:43 PM  
**To:** Dowd,Michael <mgdowd@deq.com>  
**Subject:** FW: NSR Applicability re: Mirant  
**Attach:** Mirant Past NSR Applicability Determination Review.doc; VOC Emissions After Control Equipment.doc; JD CO Policy Memo.pdf; Mirant Major NSR Timeline.xls

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-----Original Message-----

From: Katz.Judith@epamail.epa.gov [mailto:Katz.Judith@epamail.epa.gov]  
Sent: Friday, April 27, 2007 11:31 AM  
To: Sydnor,James  
Cc: Paylor,David; Steers,Jeffery; Golden,James; Dowd,Michael; Weeks,Richard; Thompson,Tamera; Campbell.Dave@epamail.epa.gov

Subject: Re: NSR Applicability re: Mirant

Thanks, Jim. We will do our best to meet your deadline of May 15. We are also working on an answer to your question about credit for merging the stacks, and hope to have that answer by then as well. Judy

"Sydnor,James"  
<jesydnor@deq.virginia.gov>  
04/27/2007 10:09 AM  
To  
Judith Katz/R3/USEPA/US@EPA  
cc  
"Thompson,Tamera"  
<unthompson@deq.virginia.gov>,  
"Golden,James"  
<jjgolden@deq.virginia.gov>,  
"Weeks,Richard"  
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"Paylor,David"  
<dkpaylor@deq.virginia.gov>,  
"Steers,Jeffery"  
<jasteers@deq.virginia.gov>,  
"Dowd,Michael"  
<mgdowd@deq.virginia.gov>  
Subject  
NSR Applicability re: Mirant

Judy,

Attached is the information regarding our NSR applicability determination for the Mirant Potomac River Generating Station. As we

DEQ-1B-02574

discussed, we are requesting your review of this documentation and EPA's opinion regarding our conclusions that NSR was not triggered at this facility as a result of the installation of LNBs, SOFA, and the Trona system. Your reply by May 15th is requested. Please let us know if you have questions or wish to discuss this further.

James E. Sydnor  
Va. Dept. of Env. Quality  
Director, Air Division  
804-698-4424

(See attached file: Mirant Past NSR Applicability Determination Review.doc)(See attached file: VOC Emissions After Control Equipment.doc)(See attached file: JD CO Policy Memo.pdf)(See attached file: Mirant Major NSR Timeline.xls)

## Summary of Past NSR Applicability Determination Review for the Mirant Potomac River Generating Station

The Department of Environmental Quality staff conducted a review of all past actions conducted by the Mirant Potomac River Generating Station (PRGS) in Alexandria, Virginia to determine whether New Source Review (NSR) should have applied. Staff evaluated over 75 different projects that have taken place in the past several years with a focus on three specific projects. The projects were the installation of Low NO<sub>x</sub> Burners (LNB), Separated Over-Fired Air (SOFA) and Trona. After review by DEQ staff, it has been determined that NSR applicability was not triggered as a result of these actions at PRGS.

### Installation of Low NO<sub>x</sub> Burners

As a result of the federal Consent Decree, LNBs were installed at PRGS in April 2004 for units 3, 4, & 5 and September 2004 for units 1 & 2. At the time of installation, EPA's NSR reform regulations (promulgated 12/31/2002) had a provision for Pollution Control Projects (PCP) which allows for an increase of one pollutant if the decrease in another pollutant is more environmentally beneficial. In the case of LNB, the slight increase in CO is offset by the decrease in NO<sub>x</sub>. In the 2002 regulations, EPA specifically listed LNB as an acceptable PCP. Additionally, in 2004, Virginia was utilizing a July 19, 1999, Policy Memo signed by the then DEQ Air Director, John Daniel titled "Incidental CO Emission Increases from Utility Control Efforts" which allows a source the option of not obtaining a permit for the increase of CO as a result of installing LNB. Although the D.C. Circuit Court vacated the PCP provision of the 2002 regulations on June 24, 2005, at the time the actions took place, PCPs were acceptable both under the federal regulations and state policy.

### Installation of Separated Over-Fired Air (SOFA)

The installation of SOFA was also required as a result of the federal Consent Decree. SOFA was installed on units 3, 4, & 5 in February 2005. SOFA is also control equipment that reduces NO<sub>x</sub> but may cause an increase in CO and VOCs. As with LNB, the PCP portion of the federal NSR reform regulations was still in effect. In addition, and more importantly to the state program, the DEQ policy specifically addressing incidental CO increases as a result of installing NO<sub>x</sub> controls was being implemented. The DEQ policy is not limited to LNB. Although it is not specifically listed in the federal regulations as a PCP, it is reasonable to conclude that any subsequent decrease in NO<sub>x</sub> would be considered more environmentally beneficial than any slight increase in CO. Regarding VOCs, based on calculations of potential increase in VOC emissions as a result of adding SOFA, it was determined there would be a maximum potential increase of 20.71 tpy. This was calculated using a worse case scenario of future potential to emit of all five boilers at 8760 (28.7 tpy) and subtracting the 2002 – 2003 baseline actual emissions of 23.96 tpy VOC. (2004 was not deemed as a representative year since the facility was shut down part of the year for installation of controls.) The difference of



4.74 tpy is below the significance level of 40 tpy as well as the 25 tpy significance level in a non-attainment area. Therefore, it was determined that no permit action was necessary for the installation of SOFA.

#### Installation of Trona

The installation of Trona was required by the June 1, 2006, EPA Administrative Consent Order (ACO). The Trona system was installed in February 2005. The Trona system was installed to decrease the SO<sub>2</sub> emissions but it was evaluated for a possible increase in particulate emissions that could have triggered major NSR. Since the installation of Trona, stack testing was conducted to determine if adding Trona results in an increase of PM from the stacks. The stack test showed that adding Trona actually results in a decrease of emissions from the stacks. The Trona system is enclosed and therefore no fugitive emissions are predicted to result from the unloading and injection processes. Additionally, particulate fugitives from the ash handling and road dust were evaluated. Based on the submitted permit application, there is a projected increase of total fugitive PM of approximately 5 tpy as a result of installing the Trona system. Part of the Federal Consent Decree required PRGS to implement controls to reduce PM emissions. This included: 1) Bottom Ash and Fly Ash Silo Vent Secondary Filtration; 2) Coal Pile Wind Erosion and Dust Suppression; 3) Coal Stackout Conveyor Dust Suppression; 4) Ash Loader Upgrade; 5) Ash Loading System Dust Suppression; 6) Coal Railcar Unloading Dust Suppression; 7) Settled Dust Study; and 8) Truck Washing Facility. The estimated reduction of PM emissions from these projects was estimated to be 48 tpy. Several of these projects have already been completed at the facility. The large decrease in PM emissions from these projects would offset the estimated emissions increase resulting from the installation of the Trona system. Therefore, it was determined that no permit action was necessary for the installation of the Trona System.

#### Conclusion

In conclusion, VADEQ made the determination that none of these three past actions would have triggered Major NSR.

#### Enclosures:

Mirant Major Source Timeline

VADEQ Policy – “Incidental CO Emission Increases from Utility NO<sub>x</sub> Control Efforts”

Calculated VOC Emissions

4/27/07

### Calculated VOC Emissions from Adding Control Equipment Mirant Potomac River Generating Station

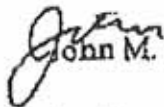
The VOC emissions were evaluated in relation to the Trona and SOFA projects. By default the baseline evaluation would have been no LNB and no SOFA (2002 and 2003 baseline determination) and the post LNB and SOFA installations (FPTE determinations for the SOFA and Trona). The following table provides the information on these emissions.

Calculated VOC Emissions						
Condition	Unit 1 (tons/yr)	Unit 2 (tons/yr)	Unit 3 (tons/yr)	Unit 4 (tons/yr)	Unit 5 (tons/yr)	TOTAL (tons/yr)
Pre LNB/SOFA (2002- 2003 baseline)	5.45	5.74	7.66	7.96	8.34	35.15
Post LNB/SOFA including Trona Injection (PTE)	9.66	9.66	9.57	9.57	9.57	48.03

- The Pre LNB/SOFA emissions are the actual emissions reported for the 2002 and 2003 baseline years.
- The Post LNB/SOFA emissions are the projected emissions assuming 8,760 hours/yr and with Trona injection.
- The increase in emissions is 12.88 tons/yr which is less than both the significances levels for both PSD (40 tons/yr) and non-attainment (25 tons/yr).

DEPARTMENT OF ENVIRONMENTAL QUALITY  
INTRA-AGENCY MEMORANDUM

TO : Karen J. Sismour, Regional Permit Manager, TRO

FROM :  John M. Daniel, Jr., PE, DEE, Director, Division of Air Program Coordination

SUBJECT : Incidental CO Emission Increases from Utility NOx Control Efforts

DATE : July 19, 1999

The decision to permit incidental emission increases of carbon monoxide resulting from required NOx control efforts at electric utility power plants should be left to the owner. No compliance or enforcement efforts should be directed against any facility choosing not to seek a permit for such increases.

Our permit rule (9 VAC 5-80-1100) addresses such issues by excluding the addition of pollution control systems from the definition of "modification". While this does not strictly apply to major modifications under the PSD or nonattainment provisions, such increases are exempted under federal regulations in the form of the "WEPCO Rule" (57 FR 32314). Further, EPA issued a guidance document July 1, 1994, (John S. Seitz, Director EPA OAQPS, memo titled "Pollution Control Projects and New Source Review (NSR) Applicability"; see electronic file located at K:\AGENCY\EPABULL\AIR\GUIDANCE\PCPGUIDE.WPS) which extended the concept of the pollution control project exclusion to non-utility facilities. Our lack of adoption of the WEPCO rule is simply a matter of timing. We had intended to incorporate it at the same time we adopted changes to major source permit rules following EPA's adopting its new source review reform package. Unfortunately, that reform effort stalled. In hindsight, we probably should have adopted our version of the WEPCO rule separately.

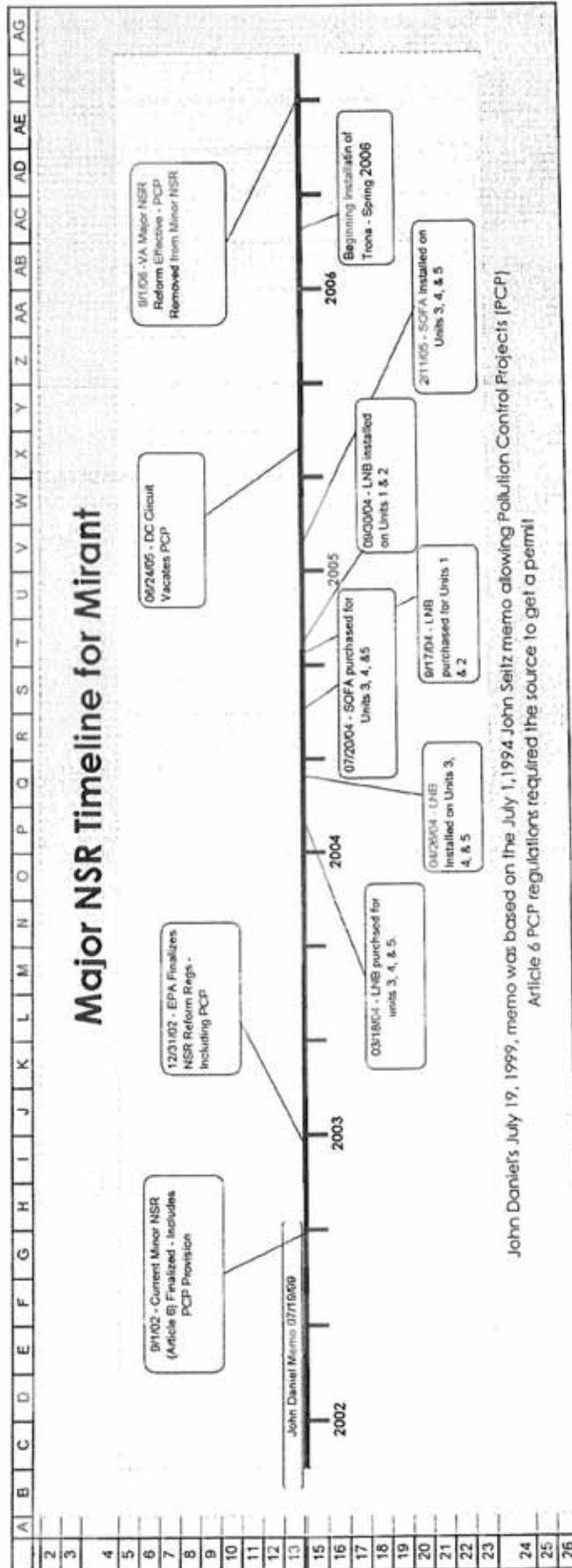
While the July 1, 1994, EPA document does say it is for non-utility facilities only, it also mentions that for years prior EPA had exempted pollution control projects from major source permit requirements on a case by case basis. In that vein, I consider all changes made at Virginia utility plants solely to comply with tighter NOx emission limits imposed by us to qualify for exclusion from both minor and major modification permit requirements as far as increases in carbon monoxide emissions are concerned. The trade-off of modest amounts of CO for substantial amounts of NOx is clearly beneficial from an environmental standpoint.

However, should a utility feel uncomfortable with this determination and insist on obtaining a PSD permit for the CO increase, I would reluctantly say to go ahead and process the application.

cc: Regional Directors  
Director, Office of Enforcement Coordination  
Director, Office of Air Regulatory Development  
Director, Office of Air Permit Programs

DEQ-1B-02579





per acre total volume by ground or 5 gallons of spray solution per acre by air.

Alabama's and Mississippi's 1994 requests for the use of Pirate to control the BAW on cotton were denied due to the risk of unreasonable adverse effects to non-target birds, aquatic organisms and the environment. Alabama has proposed a 75 foot buffer between cotton fields treated with Pirate and aquatic areas to mitigate these concerns.

Tebufenozide, as either the technical or the 2F formulation, produces minimal to no toxicity following acute exposures. Following subchronic or chronic exposure, tebufenozide does produce organ toxicity after multiple exposures at high doses to laboratory animals. The primary target organ for toxicity is the hemopoietic system and the toxicity was characterized as a regenerative anemia. Tebufenozide produced marginal reproductive effects following multiple exposures of very high doses to rats and was found to be moderately toxic to aquatic and aquatic invertebrate organisms and highly toxic to oysters.

This notice does not constitute a decision by EPA on the applications themselves. The regulations governing section 18 require that the Agency publish notice of receipt in the *Federal Register* and solicit public comment on an application for a specific exemption proposing use of a new chemical (i.e., an active ingredient not contained in any currently registered pesticide) (40 CFR 166.24 (a)(1)). Pirate is a new chemical.

A record has been established for this notice under docket number "[OPP-180974]" (including comments and data submitted electronically as described below). A public version of this record, including printed, paper versions of electronic comments, which does not include any information claimed as CBI, is available for inspection from 8 a.m. to 4:30 p.m., Monday through Friday, excluding legal holidays. The public record is located in Room 1132 of the Public Response and Program Resources Branch, Field Operations Division (7506C), Office of Pesticide Programs, Environmental Protection Agency, Crystal Mall #2, 1921 Jefferson Davis Highway, Arlington, VA.

Electronic comments can be sent directly to EPA at:  
opp-docket@epamail.epa.gov

Electronic comments must be submitted as an ASCII file avoiding the use of special characters and any form of encryption.

The official record for this notice, as well as the public version, as described above will be kept in paper form.

Accordingly, EPA will transfer all comments received electronically into printed, paper form as they are received and will place the paper copies in the official record which will also include all comments submitted directly in writing. The official record is the paper record maintained at the address in "ADDRESSES" at the beginning of this document.

Accordingly, interested persons may submit written views on this subject to the Field Operations Division at the address above. The Agency will review and consider all comments received during the comment period in determining whether to issue the emergency exemption requested by the Alabama Department of Agriculture, Mississippi Department of Agriculture and Commerce, Louisiana Department of Agriculture and Forestry, Tennessee Department of Agriculture and the Arkansas State Plant Board.

#### List of Subjects

Environmental protection, Pesticides and pests, Crisis exemptions.

Dated: June 23, 1995.

Peter Caulkins

Acting Director, Registration Division, Office of Pesticide Programs.

[FR Doc. 95-16555 Filed 7-6-95; 8:45 am]

BILLING CODE 5500-50-F

[OPP-36140C; FRL-4957-0]

#### Inert Ingredients in Pesticide Products; Reclassification of Certain List 3 Inert Ingredients to List 4B

AGENCY: Environmental Protection Agency (EPA).

ACTION: Notice.

**SUMMARY:** EPA is issuing a list of inert ingredients formerly considered to be inert ingredients of unknown toxicity (List 3) for which it now has sufficient information to conclude that their current use patterns in pesticide products will not adversely affect public health and the environment and can therefore be reclassified to List 4B.

**EFFECTIVE DATE:** July 7, 1995.

**ADDRESSES:** By mail, submit written comments identified by the document control number to: Public Response and Program Resources Branch, Field Operations Division (7506C), Office of Pesticide Programs, Environmental Protection Agency, 401 M St. SW., Washington, DC 20460. In person, deliver comments to: Rm. 1132, Crystal Mall Bldg. #2, 1921 Jefferson Davis Hwy., Arlington, VA 22202. Information submitted as a comment concerning this

document may be claimed confidential by marking any part or all of that information as "Confidential Business Information" (CBI). Information so marked will not be disclosed except in accordance with procedures set forth in 40 CFR part 2. A copy of the comment that does not contain CBI must be submitted for inclusion in the public record. Information not marked confidential will be included in the public docket by EPA without prior notice. The public docket is available for public inspection in Rm. 1132 at the address given above, from 8 a.m. to 4:30 p.m., Monday through Friday, excluding legal holidays.

Comments and data may also be submitted electronically by sending electronic mail (e-mail) to: opp-docket@epamail.epa.gov. Electronic comments must be submitted as an ASCII file avoiding the use of special characters and any form of encryption. Comments and data will also be accepted on disks in WordPerfect in 5.1 file format or ASCII file format. All comments and data in electronic form must be identified by the docket number, [OPP-36140C]. No Confidential Business Information (CBI) should be submitted through e-mail. Electronic comments on this proposed rule may be filed online at many Federal Depository Libraries. Additional information on electronic submissions can be found below in this document.

**FOR FURTHER INFORMATION CONTACT:** By mail: Mary Waller, Registration Support Branch, Registration Division (7505W), Environmental Protection Agency, 401 M St. SW., Washington, DC 20460. Office location and telephone number: 2800 Crystal Drive, 6th Floor, Arlington, VA 22202; (703)-308-8811; e-mail: waller.mary@epamail.epa.gov.

**SUPPLEMENTARY INFORMATION:** EPA announced its policy on toxic inert ingredients in pesticide products in the *Federal Register* of April 22, 1987 (52 FR 13305). Through its policy, EPA encourages the use of the least toxic inert ingredients available and requires the development of data necessary to determine the conditions of safe use of products that contain toxic inert ingredients. In developing this policy, EPA categorized inert ingredients into the following four lists according to toxicity:

List 1—Inerts of toxicological concern.

List 2—Potentially toxic inerts, with high priority for testing.

List 3—Inerts of unknown toxicity.

List 4—Inerts of minimal concern.

In the *Federal Register* of November 22, 1989 (54 FR 48314), EPA issued a



notice announcing some modifications to the previously published Lists 1 and 2. In that notice, EPA also noted that List 4 was being divided into two parts. The original List 4 became List 4A, representing minimal risk inert ingredients. List 4B was created to represent inert ingredients for which EPA has sufficient information to conclude that their current use patterns in pesticide products will not adversely affect public health and the environment. EPA subsequently issued List 4A in the Federal Register of September 28, 1994 (59 FR 49400).

As a part of its initial review of the inert ingredients originally categorized as List 3, EPA has identified 146 inert ingredients that merit reclassification to List 4B. The basis for this reclassification is as follows:

1. On behalf of the Office of Pesticide Programs, these substances were reviewed by the Structure Activity Team of EPA's Office of Pollution Prevention and Toxics with each judged to be of low concern for potential human health and/or environmental effects.

2. Each of these substances is either approved for use by the U.S. Food and Drug Administration as (a) a direct food additive under 40 CFR part 172 or (b) a polymer considered to not present an unreasonable risk on the basis of its conformance with the criteria given in the polymer exemption rule at 40 CFR 723.250. The polymer exemption rule exempts selected low-risk polymers from part or all of the premanufacture notification provisions of section 5 of the Toxic Substances Control Act (TSCA).

3. These inert ingredients were evaluated by the Office of Pesticide Program's Inert Review Group and determined to be of minimal risk.

A list of these inert ingredients proposed for reclassification was provided to EPA's Office of Water and to FDA's Center for Food Safety and Applied Nutrition for comment; no adverse comments were received.

This reclassification is expected to be the first in a series of actions related to the disposition of inert ingredients currently on Lists 2 and 3. EPA is continuing its review of other List 2 and List 3 inert ingredients under the inerts strategy and, following its assessment, will make further determinations regarding inert ingredient categorization.

#### LIST 4B.—INERT INGREDIENTS

CAS Reg. No.	Chemical name
57-55-6	Propylene glycol
67-63-0	Isopropyl alcohol
71-36-3	1-Butanol
80-56-8	alpha-Pinene
91-53-2	ethoxyquin
94-13-3	Propyl p-hydroxybenzoate
98-86-2	Acetophenone
99-76-3	Methyl p-hydroxybenzoate
102-76-1	Glyceryl triacetate
106-97-8	n-Butane
111-27-3	1-Hexanol
111-70-6	1-Heptanol
112-30-1	1-Decanol
120-72-9	1H-Indole
123-95-5	Butyl stearate
124-07-2	Octanoic acid
124-10-7	Methyl tetradecanoate
139-44-6	Glyceroltris (12-hydroxystearate)
141-78-6	Ethyl acetate
151-21-3	Dodecyl sulfate, sodium salt
527-07-1	Gluconic acid, sodium salt
527-09-3	Cupric gluconate
533-96-0	Sodium sesquicarbonate
860-22-0	FD & C Blue No. 2
868-18-8	Sodium tartrate
1302-42-7	Sodium aluminate
1310-58-3	Potassium hydroxide
1310-73-2	Sodium hydroxide
1338-41-6	Sorbitan monostearate
1343-98-2	Silicic acid
7558-79-4	Disodium phosphate
7722-88-5	Diphosphoric acid, tetrasodium salt
7722-88-5	Tetrasodium pyrophosphate
7664-93-9	Sulfuric acid
7758-16-9	Sodium acid pyrophosphate
7784-25-0	Aluminum ammonium sulfate
7785-87-7	Manganese sulfate
8009-03-8	Petrolatum
8015-86-9	Carnauba wax
8050-33-7	Polyoxyethylene ester of rosin
8061-51-6	Lignosulfonic acid, sodium salt
8061-52-7	Lignosulfonic acid, calcium salt
9002-89-5	Polyvinyl alcohol
9002-92-0	Polyoxyethylene dodecyl mono ether
9003-06-9	Acrylamide-acrylic acid resin
9003-07-0	Polypropylene
9003-11-6	Polyoxyethylene-polyoxypropylene copolymer



## LIST 4B.—INERT INGREDIENTS—Continued

CAS Reg. No.	Chemical name
9003-49-0 .....	Polymerized butyl acrylate
9003-55-8 .....	Butadiene-styrene copolymer
9004-62-0 .....	2-Hydroxyethyl cellulose
9004-64-2 .....	Cellulose, 2-hydroxypropyl ether
9004-65-3 .....	2-Hydroxypropyl methyl cellulose
9004-67-5 .....	Methyl cellulose
9004-81-3 .....	Polyoxyethylene monolaurate
9004-82-4 .....	Dodecanol, ethoxylated, monoether with sulfuric acid, sodium salt
9004-95-9 .....	Polyoxyethylene monohexadecyl ether
9004-96-0 .....	Polyoxyethylene monooleate
9004-98-2 .....	Polyoxyethylene mono(cis-9-octadecenyl) ether
9004-99-3 .....	Polyoxyethylene monostearate
9005-00-9 .....	Polyoxyethylene monooctadecyl ether
9005-07-6 .....	Polyoxyethylene dioleate
9005-08-7 .....	Polyoxyethylene distearate
9005-37-2 .....	Propylene glycol alginate
9005-64-5 .....	Polyoxyethylene sorbitan monolaurate
9005-65-6 .....	Polyoxyethylene sorbitan monooleate
9005-66-7 .....	Polyoxyethylene sorbitan monopalmitate
9005-67-8 .....	Polyoxyethylene sorbitan monostearate
9005-70-3 .....	Polyoxyethylene sorbitan trioleate
9005-71-4 .....	Polyoxyethylene sorbitan tristearate
9007-48-1 .....	Polyglycerol ester of oleic acid
9011-14-7 .....	Polymethyl methacrylate
9011-29-4 .....	Polyoxyethylene sorbitol hexastearate
9014-85-1 .....	Polyethylene glycol ether with ether with 1,4-diisobutyl-1,4-dimethylbutynediol (2:1)
9014-90-8 .....	Nonylphenol, ethoxylated, monoether with sulfuric acid, sodium salt
9014-92-0 .....	Polyoxyethylene dodecylphenol
9014-93-1 .....	Polyoxyethylene dinonylphenol
9016-45-9 .....	Polyoxyethylene nonylphenol
9036-19-5 .....	Polyoxyethylene (1,1,3,3-tetramethylbutyl) phenyl ether
9038-29-3 .....	Oxirane, methyl-, polymer with oxirane, decyl ether
9038-95-3 .....	Polyethylene-polypropylene glycol, monobutyl ether
9081-17-8 .....	Nonylphenol, ethoxylated, monoether with sulfuric acid
9084-06-4 .....	Naphthalenesulfonic acid, polymer with formaldehyde, sodium salt
10124-56-8 .....	Sodium hexametaphosphate
12173-47-6 .....	Hectorite
25231-21-4 .....	Polyoxypropylene monostearyl ether
25322-68-3 .....	Polyethylene glycol
25322-69-4 .....	Polypropylene glycol
25496-72-4 .....	Glyceryl monooleate
25719-52-2 .....	Dodecyl 2-methylacrylate polymer
25719-60-2 .....	beta-Pinene homopolymer
26027-38-3 .....	p-Nonylphenol, ethoxylated
26183-44-8 .....	Dodecyl alcohol, ethoxylated, monoether with sulfuric acid
26183-52-8 .....	Polyoxyethylene monodecyl ether
26266-57-9 .....	Sorbitan monohexadecanoate
26635-76-7 .....	Glycols, polyethylene, mono(oleylamines)- ethyl ester
26636-39-5 .....	Polyoxyethylene monoicosyl ether
26636-40-8 .....	Polyoxyethylene docosyl ether
26915-70-8 .....	Tridecanol, ethoxylated, phosphate ester
27306-79-2 .....	Polyoxyethylene monotetradecyl ether
31566-31-1 .....	Glyceryl monostearate
31800-88-1 .....	Octyloxypoly(ethyleneoxy)ethyl phosphate
37280-82-3 .....	Polyoxyethylene polyoxypropylene phosphate
37286-64-9 .....	Polyoxypropylene monomethyl ether
37340-60-6 .....	Nonylphenol, ethoxylated, phosphate ester, sodium salt
39464-64-7 .....	Dinonylphenol, ethoxylated, phosphated
41928-09-0 .....	Polyethylene glycol ether with 2,2'-methylenebis(4-(tert-octyl)phenol) (2:1)
50769-39-6 .....	Butylpolyethoxyethanol esters of phosphoric acid
51609-41-7 .....	4-Nonylphenol, ethoxylated, phosphate ester
51617-79-9 .....	Polyoxyethylene octadecylphenol
51811-79-1 .....	Nonylphenol, ethoxylated, phosphate ester
52503-15-8 .....	Polyethylene glycol nonylphenyl ether phosphate potassium salt
54116-08-4 .....	Sodium tridecylpoly(oxyethylene) sulfate
55069-68-6 .....	Polyethylene glycol hexaether with sorbitol, diester with dodecanoic and oleic acids
56388-96-6 .....	Poly(oxyethylene)tridecylacetic acid
57171-56-9 .....	Polyoxyethylene sorbitol hexaoleate
57451-03-3 .....	Nonylphenol, ethoxylated, monoether with sulfuric acid, triethanolamine salt
59139-23-0 .....	Polyethylene glycol nonylphenyl ether phosphate ethanolamine salt
60828-78-6 .....	2,6,8-Trimethyl-4-nonylpolyethylene glycol ether
60864-33-7 .....	Benzyl ether of 1,1,3,3-tetramethylbutyl phenoxypolyethoxy ethanol

## LIST 4B.—INERT INGREDIENTS—Continued

CAS Reg. No.	Chemical name
60874-89-7 .....	Polyethylene glycol ether with methylenebis(diamylphenol)
61725-89-1 .....	Oxirane methyl-, polymer with oxirane, tridecyl ether
61788-60-1 .....	Methyl esters of cottonseed oil
61790-90-7 .....	Fatty acids, tall-oil, hexaester with sorbitol, ethoxylated
61791-12-6 .....	Castor oil, ethoxylated
61791-23-9 .....	Soybean oil, ethoxylated
61791-26-2 .....	Polyethoxylated tallowamine
61827-84-7 .....	Oxirane, methyl-, polymer with oxirane, octyl ether
63089-86-1 .....	Polyoxyethylene sorbitol tetraoleate
63393-89-5 .....	Coumarone - indene resin
64754-90-1 .....	Chlorinated polyethylene
66070-87-9 .....	Polyglyceryl phthalate ester of coconut oil fatty acid
67922-57-0 .....	Polyethylene glycol nonylphenyl ether phosphate magnesium salt
68131-40-8 .....	Alcohols, C12-15, polyethoxylated
68187-71-3 .....	Calcium salts of tall-oil fatty acids
68333-69-7 .....	Rosin, maleated, polymer with pentaerythritol
68425-44-5 .....	Amides, coco, N-(hydroxyethyl), ethoxylated
68441-17-8 .....	Oxidized polyethylene
68458-49-1 .....	Polyphosphoric acids, esters with polyethylene glycol nonylphenyl ether
68526-94-3 .....	Alcohols, C12-20, ethoxylated
68646-20-4 .....	Sorbitol-tall oil fatty acid sesquiesther, ethoxylated
68650-09-9 .....	Fatty acids, tall-oil, mixed esters with glycerol and polyethylene glycol
68891-29-2 .....	Alcohols, C8-10, ethoxylated, monoether with sulfuric acid, ammonium salt
69227-21-0 .....	Alcohols, C12-18, ethoxylated propoxylated
70632-06-3 .....	Alcohols, C12-15, ethoxylated, carboxylated, sodium salts
71012-10-7 .....	Oleic acid, 2-(2-(2-(2-hydroxyethoxy)ethoxy)ethoxy)ethyl ester
97043-91-9 .....	Alcohols, C9-16, ethoxylated

A record has been established for this rulemaking under docket number [OPP-36140C] (including any comments and data submitted electronically as described below). A public version of this record, including printed, paper versions of electronic comments, which does not include any information claimed as CBI, is available for inspection from 8 a.m. to 4:30 p.m., Monday through Friday, excluding legal holidays. The public record is located in Room 1132 of the Public Response and Program Resources Branch, Field Operations Division (7506C), Office of Pesticide Programs, Environmental Protection Agency, Crystal Mall #2, 1921 Jefferson Davis Highway, Arlington, VA.

Electronic comments can be sent directly to EPA at:

opp-docket@epamail.epa.gov

Electronic comments must be submitted as an ASCII file avoiding the use of special characters and any form of encryption.

The official record for this rulemaking, as well as the public version, as described above will be kept in paper form. Accordingly, EPA will transfer all comments received electronically into printed, paper form as they are received and will place the paper copies in the official rulemaking record which will also include all comments submitted directly in writing.

The official rulemaking record is the paper record maintained at the address in ADDRESSES at the beginning of this document.

#### List of Subjects

Environmental protection, Administrative practice and procedure, Agricultural commodities, Pesticides and pests, Reporting and recordkeeping.

Dated: June 23, 1995.

Peter Caulkins,

Acting Director, Registration Division, Office of Pesticide Programs.

[FR Doc. 95-16556 Filed 7-6-95; 8:45 am]

BILLING CODE 6560-60-F

[OPP-66214; FRL 4961-5]

#### Notice of Receipt of Requests to Voluntarily Cancel Certain Pesticide Registrations

AGENCY: Environmental Protection Agency (EPA).

ACTION: Notice.

**SUMMARY:** In accordance with section 6(f)(1) of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), as amended, EPA is issuing a notice of receipt of requests by registrants to voluntarily cancel certain pesticide registrations.

**DATES:** Unless a request is withdrawn by October 5, 1995, orders will be issued cancelling all of these registrations.

**FOR FURTHER INFORMATION CONTACT:** By mail: James A. Hollins, Office of Pesticide Programs (7502C), Environmental Protection Agency, 401 M St. SW., Washington, DC 20460. Office location for commercial courier delivery and telephone number: Room 216, Crystal Mall No. 2, 1921 Jefferson Davis Highway, Arlington, VA, (703) 305-5761; e-mail: hollins.james@epamail.epa.gov.

#### SUPPLEMENTARY INFORMATION:

##### I. Introduction

Section 6(f)(1) of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), as amended, provides that a pesticide registrant may, at any time, request that any of its pesticide registrations be cancelled. The Act further provides that EPA must publish a notice of receipt of any such request in the *Federal Register* before acting on the request.

##### II. Intent to Cancel

This Notice announces receipt by the Agency of requests to cancel some 31 pesticide products registered under section 3 or 24(c) of FIFRA. These registrations are listed in sequence by registration number (or company number and 24(c) number) in the following Table 1.

2101 Constitution Ave. NW., Washington DC 20418, or available for inspection at the National Archives and Records Administration (NARA). For information on the availability of this material at NARA, call 202-741-6030, or go to: [http://www.archives.gov/federal\\_register/code\\_of\\_federal\\_regulations/ibr\\_locations.html](http://www.archives.gov/federal_register/code_of_federal_regulations/ibr_locations.html).

(c) In accordance with §184.1(b)(1), the ingredient is used in food with no limitation other than current good manufacturing practice. The affirmation of this ingredient as generally recognized as safe (GRAS) as a direct human food ingredient is based upon the following current good manufacturing practice conditions of use:

(1) The ingredient is used as an antimicrobial agent as defined in §170.3(o)(2) of this chapter and a flavoring agent as defined in §170.3(o)(12) of this chapter.

(2) The ingredient is used in the following foods at levels not to exceed current good manufacturing practice: baked goods as defined in §170.3(n)(1) of this chapter; nonalcoholic beverages as defined in §170.3(n)(3) of this chapter; cheeses as defined in §170.3(n)(5) of this chapter; confections and frostings as defined in §170.3(n)(9) of this chapter; gelatins, puddings, and fillings as defined in §170.3(n)(22) of this chapter; jams and jellies as defined in §170.3(n)(28) of this chapter; meat products as defined in §170.3(n)(29) of this chapter; and soft candy as defined in §170.3(n)(38) of this chapter.

(d) Prior sanctions for this ingredient different from the uses established in this section do not exist or have been waived.

[49 FR 13142, Apr. 3, 1984]

**§ 184.1792 Sodium sesquicarbonate.**

(a) Sodium sesquicarbonate ( $\text{Na}_2\text{CO}_3 \cdot \text{NaHCO}_3 \cdot 2\text{H}_2\text{O}$ , CAS Reg. No. 533-96-0) is prepared by: (1) Partial carbonation of soda ash solution followed by crystallization, centrifugation, and drying; (2) double refining of trona ore, a naturally occurring impure sodium sesquicarbonate.

(b) The ingredient meets the specifications of the Food Chemicals Codex, 3d Ed. (1981), p. 299, which is incorporated by reference. Copies are avail-

able from the National Academy Press, 2101 Constitution Ave. NW., Washington, DC 20418, or available for inspection at the National Archives and Records Administration (NARA). For information on the availability of this material at NARA, call 202-741-6030, or go to: [http://www.archives.gov/federal\\_register/code\\_of\\_federal\\_regulations/ibr\\_locations.html](http://www.archives.gov/federal_register/code_of_federal_regulations/ibr_locations.html).

(c) In accordance with §184.1(b)(1), the ingredient is used in food with no limitation other than current good manufacturing practice. The affirmation of this ingredient as generally recognized as safe (GRAS) as a direct human food ingredient is based upon the following current good manufacturing practice conditions of use:

(1) The ingredient is used as a pH control agent as defined in §170.3(o)(23) of this chapter.

(2) The ingredient is used in cream at levels not to exceed current good manufacturing practice. Current good manufacturing practice utilizes a level of the ingredient sufficient to control lactic acid prior to pasteurization and churning of cream into butter.

(d) Prior sanctions for this ingredient different from the uses established in this section do not exist or have been waived.

[48 FR 52443, Nov. 18, 1983]

**§ 184.1801 Sodium tartrate.**

(a) Sodium tartrate ( $\text{C}_4\text{H}_4\text{Na}_2\text{O}_6 \cdot 2\text{H}_2\text{O}$ , CAS Reg. No. 868-18-8) is the disodium salt of L-(+)-tartaric acid. It occurs as transparent, colorless, and odorless crystals. It is obtained as a byproduct of wine manufacture.

(b) The ingredient meets the specifications of the Food Chemicals Codex, 3d Ed. (1981), p. 303, which is incorporated by reference. Copies are available from the National Academy Press, 2101 Constitution Ave. NW., Washington, DC 20418, or available for inspection at the National Archives and Records Administration (NARA). For information on the availability of this material at NARA, call 202-741-6030, or go to: [http://www.archives.gov/federal\\_register/code\\_of\\_federal\\_regulations/ibr\\_locations.html](http://www.archives.gov/federal_register/code_of_federal_regulations/ibr_locations.html).



**§ 582.1666 Propylene glycol.**

(a) *Product.* Propylene glycol.

(b) *Conditions of use.* This substance is generally recognized as safe (except in cat food) when used in accordance with good manufacturing or feeding practice.

[41 FR 38657, Sept. 10, 1976, as amended at 61 FR 19544, May 2, 1996]

**§ 582.1685 Rennet.**

(a) *Product.* Rennet (rennin).

(b) *Conditions of use.* This substance is generally recognized as safe when used in accordance with good manufacturing or feeding practice.

**§ 582.1711 Silica aerogel.**

(a) *Product.* Silica aerogel as a finely powdered microcellular silica foam having a minimum silica content of 89.5 percent.

(b) [Reserved]

(c) *Limitations, restrictions, or explanation.* This substance is generally recognized as safe when used as a component of antifoaming agents in accordance with good manufacturing or feeding practice.

**§ 582.1721 Sodium acetate.**

(a) *Product.* Sodium acetate.

(b) *Conditions of use.* This substance is generally recognized as safe when used in accordance with good manufacturing or feeding practice.

**§ 582.1736 Sodium bicarbonate.**

(a) *Product.* Sodium bicarbonate.

(b) *Conditions of use.* This substance is generally recognized as safe when used in accordance with good manufacturing or feeding practice.

**§ 582.1742 Sodium carbonate.**

(a) *Product.* Sodium carbonate.

(b) *Conditions of use.* This substance is generally recognized as safe when used in accordance with good manufacturing or feeding practice.

**§ 582.1745 Sodium carboxymethylcellulose.**

(a) *Product.* Sodium carboxymethylcellulose is the sodium salt of carboxymethylcellulose not less than 99.5 percent on a dry-weight basis, with maximum substitution of 0.95

carboxymethyl groups per anhydroglucose unit, and with a minimum viscosity of 25 centipoises for 2 percent by weight aqueous solution at 25 °C.

(b) *Conditions of use.* This substance is generally recognized as safe when used in accordance with good manufacturing or feeding practice.

**§ 582.1748 Sodium caseinate.**

(a) *Product.* Sodium caseinate.

(b) *Conditions of use.* This substance is generally recognized as safe when used in accordance with good manufacturing or feeding practice.

**§ 582.1751 Sodium citrate.**

(a) *Product.* Sodium citrate.

(b) *Conditions of use.* This substance is generally recognized as safe when used in accordance with good manufacturing or feeding practice.

**§ 582.1763 Sodium hydroxide.**

(a) *Product.* Sodium hydroxide.

(b) *Conditions of use.* This substance is generally recognized as safe when used in accordance with good manufacturing or feeding practice.

**§ 582.1775 Sodium pectinate.**

(a) *Product.* Sodium pectinate.

(b) *Conditions of use.* This substance is generally recognized as safe when used in accordance with good manufacturing or feeding practice.

**§ 582.1778 Sodium phosphate.**

(a) *Product.* Sodium phosphate (mono-, di-, and tribasic).

(b) *Conditions of use.* This substance is generally recognized as safe when used in accordance with good manufacturing or feeding practice.

**§ 582.1781 Sodium aluminum phosphate.**

(a) *Product.* Sodium aluminum phosphate.

(b) *Conditions of use.* This substance is generally recognized as safe when used in accordance with good manufacturing or feeding practice.

**§ 582.1792 Sodium sesquicarbonate.**

(a) *Product.* Sodium sesquicarbonate.

(b) *Conditions of use.* This substance is generally recognized as safe when

#### § 582.1804

used in accordance with good manufacturing or feeding practice.

#### § 582.1804 Sodium potassium tartrate.

(a) *Product.* Sodium potassium tartrate.

(b) *Conditions of use.* This substance is generally recognized as safe when used in accordance with good manufacturing or feeding practice.

#### § 582.1810 Sodium tripolyphosphate.

(a) *Product.* Sodium tripolyphosphate.

(b) *Conditions of use.* This substance is generally recognized as safe when used in accordance with good manufacturing or feeding practice.

#### § 582.1901 Triacetin.

(a) *Product.* Triacetin (glyceryl triacetate).

(b) *Conditions of use.* This substance is generally recognized as safe when used in accordance with good manufacturing or feeding practice.

#### § 582.1973 Beeswax.

(a) *Product.* Beeswax (yellow wax).

(b) *Conditions of use.* This substance is generally recognized as safe when used in accordance with good manufacturing or feeding practice.

#### § 582.1975 Bleached beeswax.

(a) *Product.* Bleached beeswax (white wax).

(b) *Conditions of use.* This substance is generally recognized as safe when used in accordance with good manufacturing or feeding practice.

#### § 582.1978 Carnauba wax.

(a) *Product.* Carnauba wax.

(b) *Conditions of use.* This substance is generally recognized as safe when used in accordance with good manufacturing or feeding practice.

### Subpart C—Anticaking Agents

#### § 582.2122 Aluminum calcium silicate.

(a) *Product.* Aluminum calcium silicate.

(b) *Tolerance.* 2 percent.

(c) *Limitations, restrictions, or explanation.* This substance is generally recognized as safe when used in table salt

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in accordance with good manufacturing or feeding practice.

#### § 582.2227 Calcium silicate.

(a) *Product.* Calcium silicate.

(b) *Tolerance.* 2 percent and 5 percent.

(c) *Limitations, restrictions, or explanation.* This substance is generally recognized as safe when used at levels not exceeding 2 percent in table salt and 5 percent in baking powder in accordance with good manufacturing or feeding practice.

#### § 582.2437 Magnesium silicate.

(a) *Product.* Magnesium silicate.

(b) *Tolerance.* 2 percent.

(c) *Limitations, restrictions, or explanation.* This substance is generally recognized as safe when used in table salt in accordance with good manufacturing or feeding practice.

#### § 582.2727 Sodium aluminosilicate.

(a) *Product.* Sodium aluminosilicate (sodium silicoaluminate).

(b) *Tolerance.* This substance is generally recognized as safe for use at a level not exceeding 2 percent in accordance with good manufacturing or feeding practice.

#### § 582.2729 Hydrated sodium calcium aluminosilicate.

(a) *Product.* Hydrated sodium calcium aluminosilicate (sodium calcium silicoaluminate).

(b) *Tolerance.* This substance is generally recognized as safe for use at a level not exceeding 2 percent in accordance with good manufacturing or feeding practice.

#### § 582.2906 Tricalcium silicate.

(a) *Product.* Tricalcium silicate.

(b) *Tolerance.* 2 percent.

(c) *Limitations, restrictions, or explanation.* This substance is generally recognized as safe when used in table salt in accordance with good manufacturing or feeding practice.

### Subpart D—Chemical Preservatives

#### § 582.3013 Ascorbic acid.

(a) *Product.* Ascorbic acid.



2. Amend § 288.7(d)(1) by adding a proviso to read as follows:

(d) For Category A transportation services on and after

(1) Passengers, 7.044 cents per passenger-mile: *Provided*, That a carrier may perform Category A passenger services at a rate per passenger-mile which, when applied to the mileage between specific points in accordance with subparagraph (3) of this paragraph, produces a product fare equal to a published, unrestricted, one-way, passenger tariff fare that is in fact available to the general public for equivalent services, in the event that the Category A rate per passenger-mile, specified above, would result in a higher charge than such published tariff.

(2) . . .

(Secs. 204, 403 and 416 of the Federal Aviation Act of 1958, as amended; 72 Stat. 743, 758 and 771, as amended; (49 U.S.C. 1324, 1373 and 1386).)

By the Civil Aeronautics Board.

PHYLLIS T. KAYLOR,  
Secretary.

APPENDIX I—SUMMARY OF SEATING CONFIGURATIONS IN CHARTER AND SCHEDULED SERVICES

Aircraft type	Carrier	Charter service	Scheduled service
B-747	AA	364-424	343
	BN	356	356
	DL	370	370
	NW	369, 375	369
	PA	373, 381, 400, 408 437, 453	373, 400
	TW	383	363
	UA	342, 374	342
	World	357, 395, 411, 423, 445, 461	—
L-1011	DL	256, 264	256
	EA	256	261
DC-10-10	AA	240	240
	UA	242, 259	241
DC-30	NA	283	269
	TIA	275, 303, 345, 378	—
DC-40	NW	236	236

WIDE-BODY AIRCRAFT SEATING DENSITIES PER MANUFACTURER'S SPECIFICATION

Aircraft type	Number of seats
B-747100/200B/200C	374-500
DC-10-30/40	250-380
L-1011-1/100/200/250	250-400

[FR Doc. 78-16235 Filed 6-12-78; 8:45 am]

[4110-03]

DEPARTMENT OF HEALTH,  
EDUCATION, AND WELFARE

Food and Drug Administration

[21 CFR Part 10]

[Docket No. 78N-0126]

SEPARATION OF FUNCTIONS AND EX PARTE COMMUNICATIONS

Withdrawal of Proposal and Termination of Rulemaking Proceedings

AGENCY: Food and Drug Administration.

ACTION: Withdrawal of proposal.

SUMMARY: The Commissioner of Food and Drugs is withdrawing a proposal to establish rules concerning separation of functions and ex parte communications. The proposal is being withdrawn because it has been superseded by more recent procedural regulations.

EFFECTIVE DATE: June 13, 1978.

FOR FURTHER INFORMATION CONTACT:

Richard T. Hunt, Compliance Regulations Policy Staff (HFC-10), Food and Drug Administration, Department of Health, Education, and Welfare, 5600 Fishers Lane, Rockville, Md. 20857, 301-443-3480.

SUPPLEMENTARY INFORMATION: In the FEDERAL REGISTER of March 24, 1972 (37 FR 6107), the Commissioner issued a proposal to establish regulations concerning separation of functions and ex parte communications. The proposal was intended, among other things, to more clearly define permissible and impermissible communication among parties to a public hearing and FDA officials, employees, and attorneys.

In the FEDERAL REGISTER of January 25, 1977 (42 FR 4680), the Commissioner adopted new comprehensive administrative practices and procedures that encompassed the issues of separation of function and ex parte communications.

Accordingly, the Commissioner announces that the proposal published in the FEDERAL REGISTER of March 24, 1972 (37 FR 6107) is now superseded and is hereby withdrawn.

This withdrawal is issued under the Federal Food, Drug, and Cosmetic Act (sec. 701, 52 Stat. 1055-1056 as amended by 70 Stat. 919 and 72 Stat. 948 (21 U.S.C. 371)) and under the Administrative Procedure Act (secs. 4.5, 60 Stat. 238, 239 as amended (5 U.S.C. 553, 554)) and under authority delegated to the Commissioner (21 CFR 5.1).

Dated: June 5, 1978.

WILLIAM F. RANDOLPH,  
Acting Associate Commissioner  
for Regulatory Affairs.

[FR Doc. 78-16089 Filed 6-12-78; 8:45 am]

[1505-01]

[21 CFR Parts 182, 184]

[Docket No. 78N-0015]

INOSITOL

Proposed Affirmation of Grac Status as a Direct Human Food Ingredient

Correction

In FR Doc. 78-13715 appearing at page 22056 in the issue for Tuesday, May 23, 1978, make the following corrections:

(1) On page 22057, in the first column, in the next to last line, "O-β-D-galactopyranosyl myo-inositol" should read "O-β-D-galactopyranosyl myo-inositol."

(2) On page 22058, in the middle column, in § 184.1341(a), in the third line, delete the space between "trans-4," and "6-cyclohexanehexol."

[4110-03]

[21 CFR Parts 182, 184, 186]

[Docket No. 78N-00711]

CARBONATES AND BICARBONATES

Proposed Affirmation of GRAS Status as Direct and Indirect Human Food Ingredients

AGENCY: Food and Drug Administration.

ACTION: Proposed rule.

SUMMARY: This is a proposal to affirm the generally recognized as safe (GRAS) status of calcium carbonate, potassium bicarbonate, potassium carbonate, sodium bicarbonate, sodium carbonate, and sodium sesquicarbonate as direct human food ingredients, and of sodium bicarbonate and sodium carbonate as indirect human food ingredients. The safety of these ingredients has been evaluated under a comprehensive safety review being conducted by the agency. The proposal would list calcium carbonate, potassium bicarbonate, potassium carbonate, sodium bicarbonate, sodium carbonate, and sodium sesquicarbonate as direct food substances affirmed as GRAS, and sodium bicarbonate and sodium carbonate as indirect food substances affirmed as GRAS.

DATE: Comments by August 14, 1978.

ADDRESS: Comments (preferably four copies) to the Hearing Clerk (HFC-20), Food and Drug Administration, room 4-65, 5600 Fishers Lane, Rockville, MD 20857.



# FOR FURTHER INFORMATION CONTACT:

Corbin I. Miles, Bureau of Foods (HFF-335), Food and Drug Administration, Department of Health, Education, and Welfare, 200 C Street SW., Washington, D.C. 20204, 202-472-4750.

## SUPPLEMENTARY INFORMATION:

The Commissioner of Food and Drugs has issued several notices and proposals (see the *FEDERAL REGISTER* of July 26, 1973 (38 FR 20040)) initiating a comprehensive safety review of human food ingredients classified as generally recognized as safe (GRAS) or subject to a prior sanction. Under this review, which is being conducted by the Food and Drug Administration (FDA), the safety of calcium carbonate, potassium bicarbonate, potassium carbonate, sodium bicarbonate, sodium carbonate, and sodium sesquicarbonate has been evaluated. Under § 170.35 (21 CFR 170.35), the Commissioner proposes to affirm the GRAS status of these ingredients. Ammonium bicarbonate, ammonium carbonate, and magnesium carbonate will be considered in other proposals on ammonium and magnesium salts, respectively.

Carbonates and bicarbonates are commonly used in foods as neutralizers and leavening agents. These anions occur in body fluids and tissues as the result of normal metabolic processes and are important in the control of acid-base balance. Their salts are usually colorless or white translucent or transparent crystals, flakes, powders, or granules. Except for calcium carbonate, most of the carbonates used in foods are fairly soluble in water. They may decompose in dry and/or moist air with temperature gradients proportionately influencing the rate of degradation.

Calcium carbonate, potassium bicarbonate, potassium carbonate, sodium bicarbonate, sodium carbonate, and sodium sesquicarbonate are listed in §§ 182.1191, 182.1613, 182.1619, 182.1736, 182.1742, and 182.1792 (21 CFR 182.1191, 182.1613, 182.1619, 182.1736, 182.1742, and 182.1792), respectively, as multiple purpose GRAS food substances, under regulations published in the *FEDERAL REGISTER* of November 20, 1959 (24 FR 9368) and subsequently recodified. Calcium carbonate is also listed in § 182.5191 (21 CFR 182.5191) as a nutrient and dietary supplement, under regulations published in the *FEDERAL REGISTER* of November 20, 1959 (24 FR 9368), and is prior sanctioned for use as a stabilizer in § 181.29 (21 CFR 181.29). Sodium bicarbonate and sodium carbonate are listed in § 182.70 (21 CFR 182.70) for use in cotton and cotton fabrics used

in dry food packaging, under regulations published in the *FEDERAL REGISTER* of June 10, 1961 (26 FR 5224). Sodium carbonate is also listed in § 182.90 (21 CFR 182.90) for use in paper and paperboard packaging materials, under regulations published in the *FEDERAL REGISTER* of June 17, 1961 (26 FR 5421).

Certain Federal standards of identity list the use of some bicarbonates and carbonates in food: Calcium carbonate in frozen desserts (Part 135 (21 CFR 135)), cereal flours and related products (Part 137 (21 CFR 137)), and food dressings and flavorings (Part 169 (21 CFR Part 169)); sodium bicarbonate in cereal flours and related products (Part 137), canned vegetables (Part 155 (21 CFR Part 155)), and cacao products (Part 163 (21 CFR Part 163)); sodium carbonate in canned vegetables (Part 155), and cacao products (Part 163); and potassium bicarbonate and potassium carbonate in cacao products (Part 163).

Sodium bicarbonate is cleared by the Meat Inspection Division (MID) of the United States Department of Agriculture, to separate fatty acids and glycerol in rendered fats, and for use as a cooling and retort water treatment agent for prevention of staining exterior surfaces of food cans. Sodium carbonate is cleared by MID to refine rendered fats, to denude mucous membranes from tripe, and as a cooling and retort water treatment agent for prevention of staining exterior surfaces of food cans. The Bureau of Alcohol, Tobacco, and Firearms has cleared calcium carbonate and sodium carbonate under § 240.1051 (27 CFR 240.1051) to reduce excess natural acids in wine. Potassium carbonate and sodium carbonate are regulated as food additives in § 173.310 (21 CFR 173.310) as components of boiler water additives. Calcium carbonate is also regulated as a food additive in § 175.300 (21 CFR 175.300) for use in resinous and polymeric coatings, and in § 177.1600 (21 CFR 177.1600) for use in polyethylene resins, carboxyl modified.

A representative cross-section of food manufacturers was surveyed to determine the specific foods in which carbonates and bicarbonates have been used and the levels of usage. Information from surveys of consumer consumption was obtained and combined with the manufacturing information to obtain an estimate of consumer exposure to these ingredients. The total amounts of these ingredients used by the United States food industry in 1970 were 33 million pounds of calcium carbonate, 37,000 pounds of potassium bicarbonate, 4 million pounds of potassium carbonate, 95 million pounds of sodium bicarbonate

and 35 million pounds of sodium carbonate. No food-use data were reported for sodium sesquicarbonate in these surveys. From industry sources, however, it was reported that 712,000 pounds of sodium sesquicarbonate were sold in 1970. The total amount of carbonates and bicarbonates (including ammonium bicarbonate and ammonium carbonate) used in food in 1970 is more than double that used in 1960.

The carbonates and bicarbonates have been the subject of a search of the scientific literature from 1920 to the present. The criteria used in the search were chosen to discover any articles that considered: (1) chemical toxicity; (2) occupational hazards; (3) metabolism; (4) reaction products; (5) degradation products; (6) any reported carcinogenicity, teratogenicity, or mutagenicity; (7) dose response; (8) reproductive effects; (9) histology; (10) embryology; (11) behavioral effects; (12) detection; and (13) processing. A total of 874 abstracts on carbonates was reviewed and 70 particularly pertinent reports from the literature survey have been summarized in a scientific literature review.

The scientific literature review shows, among other studies, the following information as summarized in the report of the Select Committee on GRAS Substances (the Select Committee), selected by the Life Sciences Research Offices of the Federation of American Societies for Experimental Biology:

The biochemical role of the bicarbonate salts has been studied for over 50 years. Investigations using radioisotope procedures have educated extensive information concerning their absorption, metabolism, excretion, and control of acid-base balance of the body. The Select Committee has found few reports of experiments expressly designed to determine the oral toxicity, mutagenicity, teratogenicity or carcinogenicity of the various carbonate compounds. Knowledge of specific toxic levels and the effects of long-term feeding on various species of animals is lacking.

Orally administered to an unstated number of rats, potassium carbonate had an LD<sub>50</sub> of 1.87 g per kg. Potassium bicarbonate caused an 80 percent increase in intercalated cells of the collecting tubules of the kidneys of rats 4.5 hours after intubation of 345 mg.

Ten chicks fed potassium bicarbonate as a 3 percent supplement to a basal diet for up to four weeks showed no signs of illness, although two chicks developed white liver nodules. In other animal studies, 11 lambs fed a concentrated ration supplemented by 2 percent of 1:1 mixture of sodium and potassium bicarbonate for 59 days showed an increase in weight gain, feed consumption and feed efficiency.

Potassium carbonate in *in vitro* microbial assays was not mutagenic in assays with *Saccharomyces cerevisiae*, strain D4 and



*Salmonella typhimurium*, strains TA-1535, TA-137, and TA-1538. Tissue homogenates for plate and suspension activation assays were prepared from liver, lungs and testes of mice, rats and monkeys.

Teratologic evaluation of potassium carbonate was performed in mice and rats. The administration of up to 290 mg per kg to pregnant mice and up to 180 mg per kg to pregnant rats for 10 consecutive days (day 6 through day 15 of gestation) had no clearly discernible effect on nidation or on maternal or fetal survival. The number of abnormalities seen in either soft or skeletal tissues of the test group did not differ from the number occurring spontaneously in the sham-treated controls.

The acute oral toxicity of sodium bicarbonate was studied in intubated Wistar SPF rats weighing 100 to 150 g. LD<sub>50</sub> levels reported were 8.9 g per kg in fed rats, 7.57 g per kg in fasted rats on wire floored cages, and 8.46 g per kg in fasted rats bedded on wood shavings. Dose volume was influential: the LD<sub>50</sub> was 3.39 g per kg in fed rats receiving 20 to 25 ml per kg, compared to 5.85 g per kg in fed rats receiving 32 ml per kg. In another study using 200 g rats, the LD<sub>50</sub> levels observed at 20 ml per kg and 50 ml per kg were 5.5±0.6 g per kg and 4.85±0.3 g per kg, respectively. Intubation of 290 to 493 mg of sodium bicarbonate caused an 80 percent increase in intercalated cells of the collecting tubules of the kidneys of rats.

The intraperitoneal injection of 18-CI of sodium [<sup>14</sup>C] bicarbonate into CFW mice was followed by assays (after 24 and 48 hours and 1, 2, 4, and 12 weeks) of blood, spleen, liver, kidneys, lungs, brain, jejunum, muscle, skin, hair, and long bones. More than 90 percent of the total radioactivity injected was lost via the respiratory route in one hour. At 24 hours, most of the radioactivity in the blood was in noncarbonate form. Specific activity in long bones paralleled that in the blood for up to 12 weeks. The radioactivity of the compound injected into a pregnant mouse was fixed in the fetal tissues more rapidly than in the maternal tissues. Variable and transient responses in erythrocyte counts and hemoglobin levels in mice to orally administered sodium bicarbonate were reported.

Rapid absorption was demonstrated in rats after intraperitoneal injection of less than one mg sodium [<sup>14</sup>C] bicarbonate. Expired radioactivity reached a maximum specific activity within 4 to 10 minutes, and by 13 to 16 minutes the specific activity was reduced by half. In a further study, rats were fasted for 24 hours and given lactate by stomach tube, followed by five intraperitoneal injections of sodium [<sup>14</sup>C] bicarbonate made at 30 minute intervals. The animals were sacrificed one-half hour later and about 60 percent of the label was accounted for. The livers were removed and the glycogen extracted; 0.3 to 1.1 percent of the administered carbon-14 was present in the glycogen. Urine contained 1.3 percent of the dose and over 50 percent of the dose was accounted for by respiratory [<sup>14</sup>C] carbon dioxide. The authors calculated that one out of eight carbon atoms present in the glycogen was derived from the bicarbonate carbon. Sodium bicarbonate has been reported to affect citrate metabolism in the kidneys of rats. An intraperitoneal injection of 672 mg per kg into four male rats caused a threefold rise in tissue citrate levels of the kidney and a smaller but significant rise in the citrate levels in the liver.

In man, at plasma bicarbonate levels below 24 mM, virtually all bicarbonate en-

tering the renal tubules is reabsorbed. Above this level the excess bicarbonate is excreted. Oral administration of sodium bicarbonate at one g per kg as a single dose increased sodium excretion and decreased blood chloride concentration and urine chloride excretion. These studies demonstrate that the carbonate and bicarbonate ions enter and are constituents of the normal metabolic pathways of man.

As reported in a preliminary paper, two groups of 22 two-week-old chicks were given water containing 0.6 and 1.2 percent sodium bicarbonate for varying periods of time. Those fed the 1.2 percent level developed lesions of yout (kidneys damaged by accumulation of urate crystals with accumulation of water in these organs and other parts of the viscera) as early as the first day. The kidneys of chicks administered 0.6 percent sodium bicarbonate became pale on the first day but did not develop lesions of gout. An autopsy showed that all chicks, fed the higher level of bicarbonate developed urate crystals in their kidneys by the third or fourth days. Mature cockerels were not injured by feeding the 1.2 percent solution, but 24 percent caused clinical signs of gout and death within five days. The investigators inferred that age and severity of lesions were inversely correlated. In another study of poultry, three two-week-old ducklings received 2 percent sodium bicarbonate in their drinking water and died within 3 days; kidney damage was reported.

Intravenous administration of sodium bicarbonate over 7 days for an average total dose of 3.7 g per kg produced no pathological changes in any of 28 rats. The total dose was given in one to seven daily injections, the average being 3.7 injections. The same investigators reported no pathological kidney changes in nine rabbits receiving 2.3 g per kg of sodium bicarbonate intravenously or in four rabbits receiving 6.4 g per kg subcutaneously over a one-week period.

Additional effects on metabolism have been reported in rats and guinea pigs. Intubation of 0.2 to 0.5 g of sodium bicarbonate decreased the amount of liver glycogen in fasted rats within 3 hours. When fed in the diet, it induced increased excretion of  $\beta$ -hydroxybutyric acid and lactic acid in the urine of rats. In the guinea pig, sodium bicarbonate fed for 15 days at a level of 400 mg per kg with ascorbic acid resulted in an increased concentration of ascorbic acid in the adrenals and livers as compared to controls fed ascorbic acid. These observations were apparently not associated with pathologic changes.

The effect of sodium bicarbonate upon gastric secretion was studied in five dogs. Intubation of 75 to 100 mg sodium bicarbonate per kg three times daily increased gastric secretory activity a short time after a meal; later the secretory volume decreased. In a 19 kg dog intravenous injection of 27.4 to 42.5 g of sodium bicarbonate induced alkalosis and caused a decrease in serum calcium, chloride and phosphorus but with a large increase in total base, sodium, and blood bicarbonate. Intravenous addition of sodium chloride did not alter the severity of the alkalosis, and the sodium and total base values were further elevated.

Potassium was retained and ammonia formation decreased in a 25-year-old man who consumed 8.4 g sodium bicarbonate daily (122 mg per kg) for six days. Six adult humans ingested 120 mg per kg of sodium bicarbonate daily for five days. Urine calcium decreased significantly for all six sub-

jects when compared to that of a similar control diet period.

Thirty-three patients with gastric or peptic ulcers were treated via gastric tube with sodium bicarbonate in daily doses of up to 100 g at a constant rate for three weeks. All developed alkalosis as plasma carbon dioxide content rose. Inulin and endogenous creatinine clearances indicated no impairment of renal function. The glomerular filtration rate increased during treatment, but it tended to drop to subnormal and recover to normal levels when therapy stopped. No renal damage was observed. Large amounts of sodium were apparently retained in an expanded extracellular space. Oral administration of large doses (840 mg per kg per day) to an infant for 8 days also caused sodium retention. One 23-year-old patient (54 kg) received a total dose of 3.2 kg sodium bicarbonate over a period of 20 months for treatment of duodenal ulcer, without marked difference in acid-base balance or decrease in urea clearance and with no change in red and white blood cell counts or hemoglobin values.

The effect of oral and intravenous administration of sodium bicarbonate to dogs was studied. One kidney was surgically removed from each dog for comparison of pre- and post-treatment morphology. Nine dogs received gradually increased doses from 5 to 60 g sodium bicarbonate (up to 10 g per kg) per day. Five of these dogs received oral doses for 30 to 114 days. The remaining four dogs received oral doses of sodium bicarbonate daily and intravenous injection each week for a period of 125 to 261 days. Two dogs in the oral dose group survived; the rest died in acute alkalosis. Renal lesions of toxicity were hyperemia, edema and protein precipitation in the tubules. The dogs receiving the intravenous supplement had the greatest renal damage.

In humans, sodium bicarbonate temporarily decreases protease and amylase activity when introduced directly into the jejunum in isotonic solution. Cardiac and respiratory rate increases associated with hard exercise were more pronounced under the influence of sodium bicarbonate fed to adult men as a single dose (100 mg per kg). Marked diuresis occurred during fatigue. Decreased plasma levels and decreased excretion of ascorbic acid in the urine were observed during a two-week study when 15 g of sodium bicarbonate was fed daily to two female subjects on a diet containing 67 mg of ascorbic acid. Drug interactions reported included an increased absorption rate of sulfadiazine when taken with sodium bicarbonate on an empty stomach but sodium bicarbonate apparently delayed absorption of sulfadiazine if given after a meal.

Sodium bicarbonate was not mutagenic in *in vitro* assays with *Salmonella* or *Saccharomyces*. Sodium bicarbonate and sodium carbonate were not teratogenic in mice or rats. Sodium carbonate was neither toxic nor teratogenic in the chick embryo at levels up to 200 mg per kg.

Studies of metabolism and excretion have included intraperitoneal implantation of 0.40 mCi of calcium [<sup>45</sup>C] carbonate as a pellet in a male rat. About 72 percent of the radioactivity was excreted as respiratory carbon dioxide between 2 and 142 hours after implantation (most after 60 hours). About 30 percent of the dose was recovered in unabsorbed pellet. Urinary radioactivity accounted for 0.27 percent and fecal radioactivity for about 0.07 percent of the dose; 1 percent of the absorbed dose was retained



by the tissues. Significant amounts of radioactivity were incorporated into the inorganic fraction of bone and into bone protein, dentin and enamel, as well as in fatty acids, glycerol, hemin, red cell protein, plasma protein, liver and muscle glycogen, muscle protein and the proteins of the testes, thoracic and abdominal viscera; in the kidney, the highest concentration was in the cortex. The same investigators distributed the compound over the peritoneal viscera of a male rat and collected exhaled air. The largest amount of radioactivity in respiratory carbon dioxide was present on the 7th and 8th days; none was detected on the 22nd day.

Calcium [ $^{14}\text{C}$ ] carbonate injected into a rat produced a higher specific activity in the saturated fatty acids than in the unsaturated fatty acids. Similar results were obtained with sodium [ $^{14}\text{C}$ ] carbonate. The carbon-14 content of the carboxyl carbon atoms was twice as high as the average for all fatty acid carbon atoms. Five rats were fed [ $^{14}\text{C}$ ] calcium carbonate for three days at 3 g per kg of feed (0.3 g per kg body weight). All rats remained healthy; calcium-45 was deposited in the femur, demonstrating the availability of calcium in the carbonate form.

In humans it has been reported that calcium carbonate taken orally in single doses from 16 to 200 mg per kg caused a transient rise in blood serum calcium. After 40 g (0.66 g per kg) calcium carbonate was fed daily for 4 days to three adult humans with peptic ulcers, a large reduction of urinary potassium was observed.

Addition of calcium carbonate to the basal diet at levels of 1 and 3 percent resulted in lower tissue iron values in anemic rats; this was interpreted as a disturbance in the normal concentration of inorganic ions in the principal absorptive portions of the digestive tract. Other investigators have shown that low intake of calcium and a high intake of phosphorus can cause impaired iron utilization with anemia. Under some circumstances either calcium salts or phosphate salts may improve iron absorption, while an excess of either may inhibit iron absorption. Calcium carbonate at 7.26 g per pound of flour in an 80 percent bread diet for 10 weeks in anemic rats (about 0.3 g  $\text{CaCO}_3$  daily per kg body weight) decreased food consumption and decreased weight gain. Even though the treated diet contained supplemental iron, the iron content of the liver decreased and hemoglobin regeneration was retarded; heart weights increased. It was postulated that the calcium saturated the alimentary mucosal cells, presenting a block to the absorption of iron. The calcium:phosphorus ratio of the experimental diet was about 5:1.

Feeding a cariogenic ration consisting largely of coarsely ground corn supplemented with 3 percent calcium carbonate and 2 to 4 I.U. vitamin D for about four months to three groups of weanling rats resulted in marked reduction of weight gain but had no effect on dental caries incidence.

In humans, the oral administration of calcium carbonate to 28 peptic ulcer patients at a level of 500 mg per kg per day, divided into hourly doses during waking hours for three weeks, resulted in six patients developing hypercalcemia (five within 72 hours) with nausea, vomiting, anorexia, weakness, lethargy, headache, and dizziness. Blood urea nitrogen values increased significantly.

After withdrawal of calcium carbonate the serum calcium values returned to normal.

Calcium retention increased 86.3 percent, and urinary calcium output also increased, when a basal diet providing 1 g calcium daily was supplemented with 2.5 g calcium carbonate and fed to 10 men for 10 days. This provided calcium carbonate at 40 mg per kg and a daily calcium intake of 2 g.

Female Swiss mice were bred after one week on diets which were supplemented by 0.5, 1.0, and 2.0 percent of calcium carbonate. First and second litters were studied. The highest levels of calcium carbonate gave a calcium carbonate intake of about 3 g per kg body weight and a calcium:phosphorus ratio of 2.3:1. This diet significantly lowered the number and total weight of the weanling mice and increased the number and proportion of deaths as compared to a control diet. The control diet provided 0.34 percent calcium and a calcium:phosphorus ratio of 0.70:1. The diet having the highest calcium content caused hypertrophy of the heart and a tendency toward decrease in thymus weight in the weanling rats. These changes were prevented by supplementing the maternal diets with iron. It has been pointed out in another report by the Select Committee that an excess of dietary calcium may precipitate a deficiency of zinc and perhaps certain other trace inorganic elements.

No specific biological information on sodium sesquicarbonate is available to the Select Committee.

All of the available safety information on bicarbonates and carbonates has been carefully evaluated by qualified scientists of the Select Committee. It is the opinion of the Select Committee that:

\*\*\* [It] is not aware of any long-term experimental studies on chronic administration of any of the carbonate salts. The results of acute toxicity and short-term feeding experiments are not readily extrapolated in determining toxic levels for carbonate salts consumed by humans. Treatment of gastric or peptic ulcers in patients with large amounts of carbonate salts in various forms has been utilized for many years and only rarely have deleterious results of changes of acid-base balance been reported. When the human respiratory and renal functions are normal, the mechanisms for

disposing of bicarbonate intake in large amounts through excretion appear to be highly efficient.

Studies of mice suggest that large intakes of calcium carbonate may interfere with reproductive performance. Such effects could be indirectly attributable to certain trace nutrient deficiencies. Comparable intake levels of calcium may occur when calcium carbonate is used for therapeutic purposes but the amounts added to foods in normal manufacturing processes are not high enough to be harmful. While the Select Committee is not aware of any studies on sodium sesquicarbonate *per se*, reasoned judgment suggests its biochemical conversion and metabolism would be similar to that of sodium carbonate and bicarbonate.

The Select Committee concludes that there is no evidence in the available information on calcium carbonate, potassium carbonate, potassium bicarbonate, sodium carbonate, sodium bicarbonate, or sodium sesquicarbonate that demonstrates or suggests reasonable grounds to suspect a hazard to the public when used at levels that are now current or that might reasonably be expected in the future. Based upon his own evaluation of available information on these carbonates and bicarbonates, the Commissioner concurs with this conclusion. The Commissioner therefore maintains that no change in the current GRAS status of these ingredients is justified. Ammonium bicarbonate, ammonium carbonate, and magnesium carbonate will be considered in other proposals on ammonium and magnesium salts, respectively.

Copies of the scientific literature review on the carbonates, mutagenic evaluations of potassium carbonate and sodium bicarbonate, teratogenic evaluations of potassium carbonate, sodium bicarbonate, and sodium carbonate, and the report of the Select Committee are available for review at the office of the Hearing Clerk (HFC-20), Food and Drug Administration, Rm. 4-65, 5600 Fishers Lane, Rockville, Md. 20857, and may be purchased from the National Technical Information Service, 5285 Port Royal Road, Springfield, Va. 22161, as follows:

Title	Ordering No.	Price code	Price <sup>1</sup>
Carbonates (scientific literature review)	PB-221-231	A07	\$7.25
Potassium carbonate (mutagenic evaluation)	PB-245-501/AS	A03	4.50
Sodium bicarbonate (mutagenic evaluation)	PB-245-436/AS	A03	4.50
Potassium carbonate (teratogenic evaluation)	PB-245-522/AS	A03	4.50
Sodium bicarbonate (teratogenic evaluation)	PB-234-871/AS	A03	4.50
Sodium carbonate (teratogenic evaluation)	PB-234-868/AS	A03	4.50
Carbonates and bicarbonates (Select Committee report)	PB-254-535/AS	A03	4.50

<sup>1</sup>Price subject to change.

This proposed action does not affect the present use of bicarbonate and carbonate salts for pet food.

Therefore, under the Federal Food, Drug, and Cosmetic Act (secs. 201(s),

409, 701(a), 52 Stat. 1055, 72 Stat. 1784-1788 as amended (21 U.S.C. 321(s), 348, 371(a))) and under authority delegated to him (21 CFR 5.1), the Commissioner proposes to amend Parts 182, 184, and 186 as follows:



**PART 182—SUBSTANCES GENERALLY  
RECOGNIZED AS SAFE**

**§ 182.70 [Amended]**

1. In § 182.70 *Substances migrating from cotton and cotton fabrics used in dry food packaging* by deleting the entries for "Sodium bicarbonate" and "Sodium carbonate."

**§ 182.90 [Amended]**

2. In § 182.90 *Substances migrating to food from paper and paperboard products* by deleting the entry for "Sodium carbonate."

§§ 182.1191, 182.1513, 182.1619, 182.1736, 182.1742, 182.1792, and 182.5191 [Deleted]

3. By deleting § 182.1191 *Calcium carbonate*, § 182.1613 *Potassium bicarbonate*, § 182.1619 *Potassium carbonate*, § 182.1736 *Sodium bicarbonate*, § 182.1742 *Sodium carbonate*, § 182.1792 *Sodium sesquicarbonate*, § 182.5191 *Calcium carbonate*.

**PART 184—DIRECT FOOD SUBSTANCES AF-  
FIRMED AS GENERALLY RECOGNIZED AS  
SAFE**

4. In Part 184 by adding new §§ 184.1191, 184.1613, 184.1619, 184.1763, 184.1742, and 184.1792 to read as follows:

**§ 184.1191 Calcium carbonate.**

(a) Calcium carbonate ( $\text{CaCO}_3$ , CAS Reg. No. 471-34-1) is prepared by three common methods of manufacture:

- (1) As a byproduct in the "Lime-soda process";
- (2) By replacement of carbon dioxide in the "Carbonation process"; or
- (3) By precipitation of calcium carbonate from calcium chloride in the "Calcium chloride process."

(b) The ingredient meets the specifications of the Food Chemicals Codex, 2d Ed. (1972), as amended by the first supplement.<sup>1</sup>

(c) The ingredient is used in food as an anticaking and free-flow agent as defined in § 170.3(o)(1) of this chapter, dough strengthener as defined in § 170.3(o)(6) of this chapter, firming agent as defined in § 170.3(o)(10) of this chapter, formulation aid as defined in § 170.3(o)(14) of this chapter, leavening agent as defined in § 170.3(o)(17) of this chapter, lubricant and release agent as defined in § 170.3(o)(18) of this chapter, nutrient supplement as defined in § 170.3(o)(20) of this chapter, pH control agent as defined in § 170.3(o)(23) of this chapter, processing aid as defined in § 170.3(o)(24) of this chapter, stabilizer and thickener as defined in § 170.3(o)(28) of this chapter, and syn-

ergist as defined in § 170.3(o)(31) of this chapter.

(d) The ingredient is used in food and infant formulas, in accordance with § 184.1(b)(1), at levels not to exceed good manufacturing practice. Current good manufacturing practice results in a maximum level, as served, of 0.5 percent in baked goods as defined in § 170.3(n)(1) of this chapter, 0.02 percent in nonalcoholic beverages as defined in § 170.3(n)(3) of this chapter, 1.3 percent in breakfast cereals as defined in § 170.3(n)(4) of this chapter, 14 percent in chewing gum as defined in § 170.3(n)(6) of this chapter, 7.5 percent in confections and frostings as defined in § 170.3(n)(9) of this chapter, 0.9 percent in gelatins, puddings, and fillings as defined in § 170.3(n)(22) of this chapter, 1.2 percent in reconstituted vegetables as defined in § 170.3(n)(33) of this chapter, 1.4 percent in soft candy as defined in § 170.3(n)(38) of this chapter, 2.5 percent in sweet sauces, toppings, and syrups as defined in § 170.3(n)(43) of this chapter, 1.4 percent in infant formulas, and 0.3 percent or less in all other food categories.

**§ 184.1613 Potassium bicarbonate.**

(a) Potassium bicarbonate ( $\text{KHCO}_3$ , CAS Reg. No. 298-14-6) is made by treating a solution of potassium carbonate with carbon dioxide.

(b) The ingredient meets the specifications of the Food Chemicals Codex, 2d Ed. (1972).<sup>1</sup>

(c) The ingredient is used as a formulation aid as defined in § 170.3(o)(14) of this chapter, nutrient supplement as defined in § 170.3(o)(20) of this chapter, pH control agent as defined in § 170.3(o)(23) of this chapter, and processing aid as defined in § 170.3(o)(24) of this chapter.

(d) The ingredient is used in food and infant formulas, in accordance with § 184.1(b)(1) at levels not to exceed good manufacturing practice. Current good manufacturing practice results in a maximum level, as served, of 3 percent in confections and frostings as defined in § 170.3(n)(9) of this chapter, and 0.02 percent in infant formulas.

**§ 184.1619 Potassium carbonate.**

(a) Potassium carbonate ( $\text{K}_2\text{CO}_3$ , CAS Reg. No. 584-08-7) is produced by the electrolysis of potassium chloride followed by exposing the resultant potassium to carbon dioxide.

(b) The ingredient meets the specifications of the Food Chemicals Codex, 2d Ed. (1972).<sup>1</sup>

(c) The ingredient is used in food as a flavoring agent and adjuvant as defined in § 170.3(o)(12) of this chapter, nutrient supplement as defined in § 170.3(o)(20) of this chapter, pH control agent as defined in § 170.3(o)(23) of this chapter, and processing aid as

defined in § 170.3(o)(24) of this chapter.

(d) The ingredient is used in food, in accordance with § 184.1(b)(1), at levels not to exceed good manufacturing practice. Current good manufacturing practice results in a maximum level, as served, of 0.5 percent in baked goods as defined in § 170.3(n)(1) of this chapter, 0.01 percent in nonalcoholic beverages as defined in § 170.3(n)(3) of this chapter, 3 percent in confections and frostings as defined in § 170.3(n)(9) of this chapter, 0.2 percent in dairy product analogs as defined in § 170.3(n)(10) of this chapter, and in soft candy as defined in § 170.3(n)(38) of this chapter, and 0.09 percent in sweet sauces as defined in § 170.3(n)(43) of this chapter.

**§ 184.1736 Sodium bicarbonate.**

(a) Sodium bicarbonate ( $\text{NaHCO}_3$ , CAS Reg. No. 144-55-8) is prepared by dissolving sodium carbonate and treating the solution with carbon dioxide. As carbon dioxide is absorbed a suspension of sodium bicarbonate forms. The slurry is filtered, forming a cake which is washed and dried.

(b) The ingredient meets the specifications of the Food Chemicals Codex, 2d Ed. (1972).<sup>1</sup>

(c) The ingredient is used in food as a curing and pickling agent as defined in § 170.3(o)(5) of this chapter, dough strengthener as defined in § 170.3(o)(6) of this chapter, flavor enhancer as defined in § 170.3(o)(11) of this chapter, flavoring agent and adjuvant as defined in § 170.3(o)(12) of this chapter, leavening agent as defined in § 170.3(o)(17) of this chapter, nutrient supplement as defined in § 170.3(o)(20) of this chapter, pH control agent as defined in § 170.3(o)(23) of this chapter, processing aid as defined in § 170.3(o)(24) of this chapter, propellant and aerating agent as defined in § 170.3(o)(25) of this chapter, stabilizer and thickener as defined in § 170.3(o)(28) of this chapter, surfactant agent as defined in § 170.3(o)(29) of this chapter, and texturizer as defined in § 170.3(o)(32) of this chapter.

(d) The ingredient is used in food and infant food, in accordance with § 184.1(b)(1), at levels not to exceed good manufacturing practice. Current good manufacturing practice results in a maximum level, as served, of 6 percent in baked goods as defined in § 170.3(n)(1) of this chapter, 5.6 percent in nonalcoholic beverages as defined in § 170.3(n)(3) of this chapter, 0.07 percent in dairy product analogs as defined in § 170.3(n)(10) of this chapter, 1.3 percent in grain products and pastas as defined in § 170.3(n)(23) of this chapter, 0.8 percent in hard candy and cough drops as defined in § 170.3(n)(25) of this chapter, 2.9 percent in processed fruit and fruit juices

<sup>1</sup>Copies may be obtained from: National Academy of Sciences, 2101 Constitution Avenue NW., Washington, D.C. 20037.



as defined in §170.3(n)(35) of this chapter, 1.8 percent in soft candy as defined in §170.3(n)(38) of this chapter, 0.8 percent in infant baked goods, 0.005 percent in infant formulas, and 0.6 percent or less in all other food categories.

§184.1742 Sodium carbonate.

(a) Sodium carbonate ( $\text{Na}_2\text{CO}_3$ , CAS Reg. No. 487-19-8) is derived either from purified trona ore that has been calcined to soda ash or from trona ore calcined to impure soda ash and then purified. Sodium carbonate is also synthesized from limestone by the Solvay process.

(b) The ingredient meets the specifications of the Food Chemicals Codex, 2d Ed. (1972).<sup>1</sup>

(c) The ingredient is used in food as an antioxidant as defined in §170.3(o)(3) of this chapter, curing and pickling agent as defined in §170.3(o)(5) of this chapter, flavoring agent and adjuvant as defined in §170.3(o)(12) of this chapter, pH control agent as defined in §170.3(o)(23) of this chapter, and processing aid as defined in §170.3(o)(24) of this chapter.

(d) The ingredient is used in food, in accordance with §184.1(b)(1), at levels not to exceed good manufacturing practice. Current good manufacturing practice results in a maximum level, as served, of 0.1 percent in baked goods as defined in §170.3(n)(1) of this chapter, 0.04 percent in nonalcoholic beverages as defined in §170.3(n)(3) of this chapter, 0.4 percent in confections and frostings as defined in §170.3(n)(9) of this chapter, 0.2 percent in gelatins, puddings, and fillings as defined in §170.3(n)(22) of this chapter, 0.1 percent in processed vegetables and vegetable juices as defined in §170.3(n)(36) of this chapter, 0.3 percent in sweet sauces, toppings, and syrups as defined in §170.3(n)(43) of this chapter, and 0.05 percent or less in all other food categories.

§184.1792 Sodium sesquicarbonate.

(a) Sodium sesquicarbonate ( $\text{Na}_2\text{CO}_3 \cdot \text{NaHCO}_3 \cdot 2\text{H}_2\text{O}$ , CAS Reg. No. 533-96-0) is prepared by partial carbonation of soda ash solution followed by crystallization, centrifugation, and drying.

(b) The ingredient meets the specifications of the Food Chemicals Codex, 2d Ed. (1972).<sup>1</sup>

(c) The ingredient is used as a pH control agent as defined in §170.3(o)(23) of this chapter.

(d) The ingredient is used in cream, in accordance with §184.1(b)(1), at levels not to exceed good manufacturing practice. Current good manufacturing practice utilizes a level of the ingredient sufficient to control lactic acid prior to pasteurization and churning of cream into butter.

PART 186—INDIRECT FOOD SUBSTANCES AFFIRMED AS GENERALLY RECOGNIZED AS SAFE

5. In Part 186 by adding new §§186.1736 and 186.1742 to read as follows:

§186.1736 Sodium bicarbonate.

(a) Sodium bicarbonate ( $\text{NaHCO}_3$ , CAS Reg. No. 144-55-8) is prepared by dissolving sodium carbonate and treating the solution with carbon dioxide. As carbon dioxide is absorbed, a suspension of sodium bicarbonate forms. The slurry is filtered, forming a cake which is washed and dried.

(b) The ingredient meets the specifications of the Food Chemicals Codex, 2d Ed. (1972).<sup>1</sup>

(c) The ingredient is used as a constituent of cotton and cotton fabrics used in dry food packaging materials.

(d) The ingredient is used at levels not to exceed good manufacturing practice.

§186.1742 Sodium carbonate.

(a) Sodium carbonate ( $\text{Na}_2\text{CO}_3$ , CAS Reg. No. 487-19-8) is derived either from purified trona ore that has been calcined to soda ash or from trona ore calcined to impure soda ash and then purified. Sodium carbonate is also synthesized from limestone by the Solvay process.

(b) The ingredient meets the specifications of the Food Chemicals Codex, 2d Ed. (1972).<sup>1</sup>

(c) The ingredient is used as a constituent of food-packaging materials.

(d) The ingredient is used at levels not to exceed good manufacturing practice.

The Commissioner hereby gives notice that he is unaware of any prior sanction for the use of these ingredients in food under conditions different from those proposed herein or different from that in Part 181. Any person who intends to assert or rely on such a sanction shall submit proof of its existence in response to this proposal. The regulation proposed above will constitute a determination that excluded uses would result in adulteration of the food in violation of section 402 of the act (21 U.S.C. 342), and the failure of any person to come forward with proof of such an applicable prior sanction in response to this proposal constitutes a waiver of the right to assert or rely on such sanction at any later time. This notice also constitutes a proposal to establish a regulation under Part 181, incorporating the same provisions, in the event that such a regulation is determined to be appropriate as a result of submission of proof of such an applicable prior sanction in response to this proposal.

Interested persons may, on or before August 14, 1978, submit to the Hearing Clerk (HFC-20), Food and Drug Administration, Room 4-65, 5600 Fishers Lane, Rockville, Md. 20857, written comments regarding this proposal. Four copies of all comments shall be submitted, except that individuals may submit single copies of comments, and shall be identified with the Hearing Clerk docket number found in brackets in the heading of this document. Received comments may be seen in the above office between the hours of 9 a.m. and 4 p.m., Monday through Friday.

NOTICE.—The Food and Drug Administration has determined that this proposal will not have a major economic impact as defined by Executive Order 11821 (amended by Executive Order 11949) and OMB Circular A-107.

Dated: May 17, 1978.

WILLIAM F. RANDOLPH,  
Acting Associate Commissioner  
for Regulatory Affairs.

NOTICE.—Incorporation by reference was approved by the Director of the Office of the Federal Register on July 10, 1973, and is on file in the Federal Register Library.

[FR Doc. 16253 Filed 6-12-78; 8:45 am]

[4110-03]

[21 CFR Parts 314, 429 and 431]

[Docket No. 78N-0127]

DEFINITION OF "UNITED STATES"

Withdrawal of Proposal and Termination of  
Rulemaking Proceeding

AGENCY: Food and Drug Administration.

ACTION: Withdrawal of proposal.

SUMMARY: The Commissioner of Food and Drugs is withdrawing a proposal to define the term "United States" for establishing residency requirements or place of business requirements for authorized agents of foreign new drug applicants or manufacturers. Upon further consideration of the proposal, the Commissioner has concluded that rulemaking in this matter is not necessary.

EFFECTIVE DATE: June 13, 1978.

FOR FURTHER INFORMATION CONTACT:

Philip L. Paquin, Bureau of Drugs (HFD-30), Food and Drug Administration, Department of Health, Education, and Welfare, 5600 Fishers Lane, Rockville, Md. 20857, 301-443-7220.

SUPPLEMENTARY INFORMATION: In the FEDERAL REGISTER of July 18, 1973 (38 FR 19130), the Commissioner issued a proposal to define the term "United States." The proposed rule would have amended §§310.3 and 429.40 (21 CFR 310.3 and 429.40) (formerly 21 CFR 130.1 and 164.2 respectively, both of which were recodified